THE COMMONWEALTH OF MASSACHUSETTS
STATE RECLAMATION & MOSQUITO CONTROL BOARD

CENTRAL MASSACHUSETTS MOSQUITO CONTROL PROJECT

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www.cmmcp.org

ANNUAL REPORT 2015

printed on minimum 30% post-consumer content

PREFACE

The 2015 Annual Report of the Central Massachusetts Mosquito Control Project (the Project) has been prepared to provide the citizens and officials of the member cities and towns with information pertaining to the Project's control procedures and related activities.

As you read through this report you will notice that the Project is committed to an Integrated Pest Management (IPM) program. IPM utilizes a variety of control techniques and evaluation procedures. All control efforts are undertaken only after surveillance data has been collected and analyzed. This allows control decisions to be made based on the exact need that exists at each specific site. Environmental considerations are paramount when prescribing various control techniques.

The CMMCP Board of Commission is appointed by the State Reclamation and Mosquito Control Board to represent your community's interest. The Commissioners meet with the Executive Director and Director of Operations on a regular basis to discuss and formulate policies, and to provide their expertise in the operation of the Project. The Commissioners welcome your input, and we encourage you to schedule an appointment to visit our Project headquarters.

Copies of this report are available to key officials and departments in our member communities, as well as to the public libraries. We would encourage officials to take time from their busy schedule to read this report. Project personnel are available to answer questions you may have, and to meet with you to discuss out procedures and techniques. The Project’s website at **www.cmmcp.org** has extensive information on mosquito control in Central Massachusetts.

The Project's goal is to provide effective and environmentally sound mosquito control, reducing mosquito annoyance and the potential for the transmission of mosquito-borne diseases. Our staff of competent, well-trained employees are known throughout the member communities as individuals who take great pride in their work.

Thank you,

Richard J. Day, Chair
Board of Commissioners
Central Massachusetts Mosquito Control Project

Member, Northeastern Mosquito Control Association

Member, New Jersey Mosquito Control Association

Partner, EPA Pesticide Environmental Stewardship Program

EPA WasteWise Program

Member, Massachusetts Municipal Association

Member, MassRecycle

THE COMMONWEALTH OF MASSACHUSETTS

State Reclamation & Mosquito Control Board
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http://www.mass.gov/agr/mosquito/

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Wetlands Project Coordinator
Ms. Katrina Proctor
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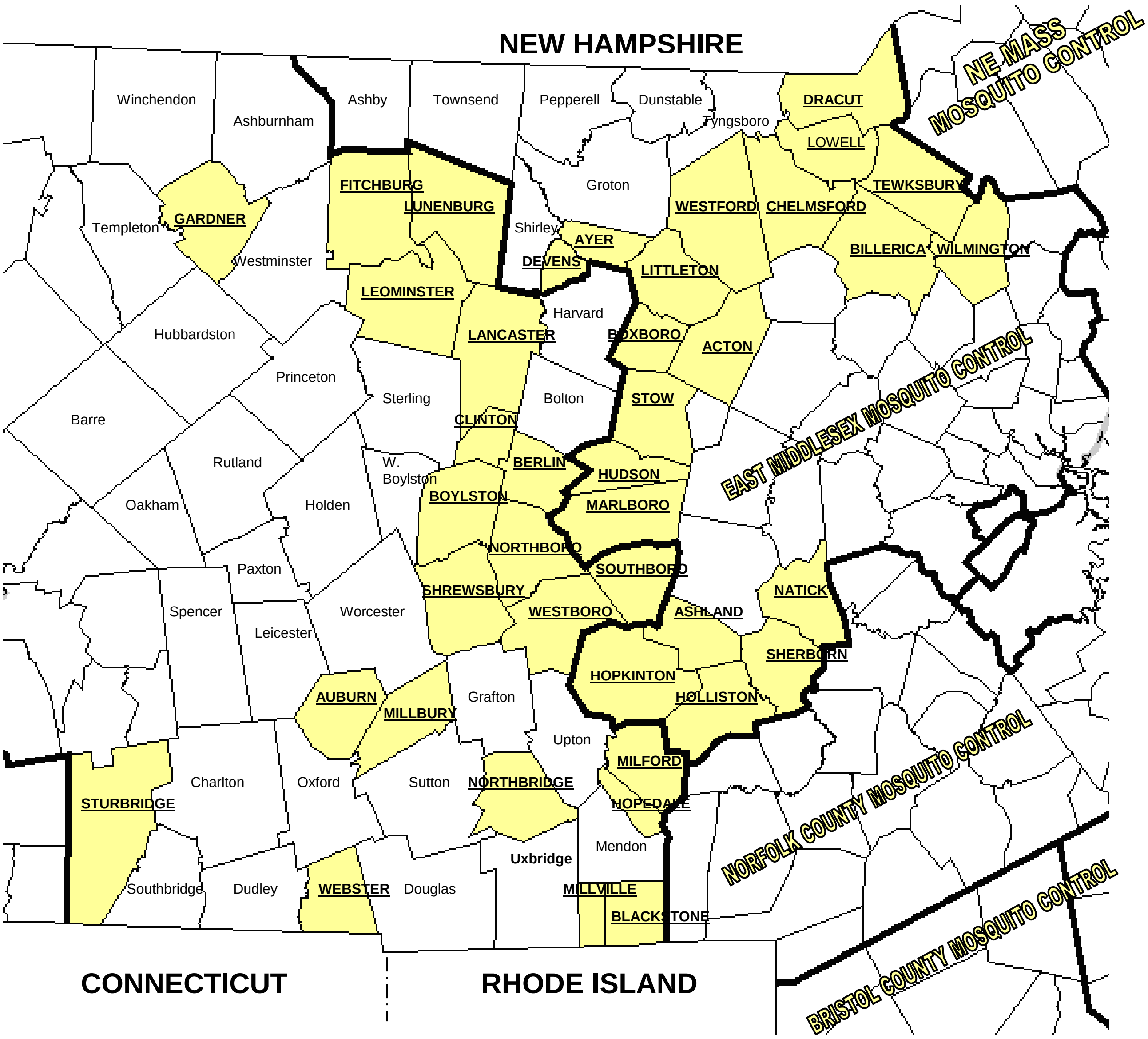
LIST OF MEMBER COMMUNITIES - 2015

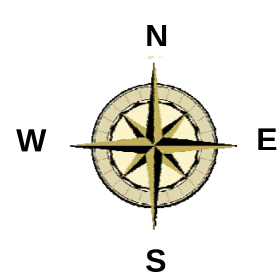
TOWN	SQUARE MILES
DISTRICT ONE	
BILLERICA	25.96
CHELMSFORD	22.70
DRACUT	20.90
LOWELL	14.50
LITTLETON	16.60
TEWKSBURY	20.70
WESTFORD	30.60
WILMINGTON	17.12
DISTRICT TWO	
ACTON	20.00
AYER	9.00
BOXBOROUGH	10.40
DEVENS	5.28
FITCHBURG	27.80
GARDNER	23.00
LANCASTER	27.70
LEOMINSTER	28.90
LUNENBURG	26.40
STOW	17.60
DISTRICT THREE	
BERLIN	12.90
BOYLSTON	16.00
CLINTON	5.70
HUDSON	11.50
MARLBOROUGH	21.10
NORTHBOROUGH	18.50
SHREWSBURY	20.70
SOUTHBOROUGH	14.10
DISTRICT FOUR	
ASHLAND	12.40
HOLLISTON	18.70
HOPEDALE	5.27
HOPKINTON	26.60
MILFORD	14.60
NATICK	15.10
SHERBORN	16.00
WESTBOROUGH	20.50
DISTRICT FIVE	
AUBURN	15.40
BLACKSTONE	10.90
MILLBURY	15.70
MILLVILLE	4.92
NORTHBRIDGE	17.20
STURBRIDGE	37.40
WEBSTER	12.50
Total Square Miles	728.85

CMMCP SERVICE AREA



~ 2015 ~

= member towns



MOSQUITO CONTROL ACTIVITIES

One basic fact of the mosquito's biology is the dependence on still, stagnant water to complete its life cycle from egg to adult. One method employed is called ''*water management* or ''*ditch maintenance*''. This method reduces or eliminates the source of potential mosquito larval habitat, and consists of cleaning road-side ditches and culverts, removal of brush and accumulated debris from ditches. This method permits water to flow freely and reduces the likelihood for stagnant areas, areas in which the larval mosquito needs to develop. This program is practiced year-round, and is done only after extensive examination by our wetland scientist and permission is received by the property owner(s).

There are places where water management is neither practical nor feasible for one reason or another. In these situations, we practice a control method for mosquito larvae called ''*larviciding*''. After a field technician has determined that larval mosquitoes are present, a small amount of environmentally sensitive product (usually a bacteria) is applied to the area according to label directions. This is often a very effective control method, reducing the emergence of the adult mosquito from that area. Larviciding is practiced from March to September or October as conditions warrant.

A third method is to attempt to control the adult mosquito. The control of adult mosquitoes is called '*adulticiding*'' and is done on a <u>*request-only*</u> basis, and the presence of adult mosquitoes is confirmed before any application is done. Adulticiding can be an effective method of *temporary* control, which can be beneficial prior to public gatherings, outdoor events and festivals, or when mosquito populations have been determined to be intolerable. Since this part of the program is done **only upon request**, this allows the individual resident to have the ultimate discretion on mosquito spraying in their area - how much or how little. Exemptions for spraying are handled through the City/Town Clerk and the Project office, and are updated each year. Adulticiding is done from approximately Memorial Day to Labor Day, depending on prevalent mosquito populations and the mosquito-borne disease situation. All products used by the Project have been extensively tested by manufacturers, the US government and mosquito control agencies for many years. They are registered by the EPA and the Mass. Pesticide Bureau. Labels and fact sheets are available upon request to the public from the Project's office, our technicians or from our website.

We operate a full surveillance program in our service area. The landing rates performed by our field staff are brought back to the Project lab to be keyed out to species, allowing us to tailor our larviciding program and reduce future dependence on adulticides. We have a mobile team of specialized mosquito traps, called ''*gravid traps*'', designed to capture virus-bearing mosquitoes. These mosquito collections, called ''*pools*'', are sent into the Mass. Dept. of Public Health (MDPH) laboratory in Jamaica Plain for testing of West Nile Virus, Eastern Equine Encephalitis, and other arboviruses of concern by MDPH. These traps are used in a rotation throughout our service area, and are then concentrated in areas showing arboviral activity to supplement MDPH's collection protocols. Additional trap types are utilized in suspect areas to monitor and evaluate the risk of viral transmission from mosquitoes to the local populace.

A comprehensive educational program is offered to area schools and civic groups. The program is aimed towards mosquito biology, mosquito habitat, and efforts citizens can undertake to reduce the potential for mosquito populations in their own neighborhood. This program is tailored to suit the requirements of the individual group, from elementary school children, to high school, to adult groups. A new program for senior citizens was established in 2011.

''*Source reduction*'' is reducing or eliminating the source of mosquito larval habitat. We offer a tire recycling program in our member communities at no additional cost to residents because used tires in the environment are larval habitat for several mosquito species, some of which carry West Nile Virus.

PROGRAM EVALUATION

This is a part of the program which many people involved directly never see. It must begin with a carefully planned program, one designed so that the data obtained during surveys before treatment and the surveys taken after treatment can be analyzed by statistically sound methods. Only by doing this can the value of a mosquito control program be determined. We will then know what type (species) of mosquito we are dealing with; what the population density is; what method(s) of control provide the most economical and efficient results. Then and only then can we say that we have or have not affected mosquito control on a level that is acceptable to the community.

SEASONAL OUTLINE OF MOSQUITO CONTROL PROGRAM

1. Wetlands Restoration/Ditch maintenance - throughout the year, intensified September through February

2. Public Education - throughout the year, intensified April through August

3. Program Preparation - December through March

4. Equipment Maintenance - December through February

5. Research & Efficacy - April through October

5. Larval Control (wetlands) - March through September (aerial work is only done in 3 towns at this time and by supplemental funding)

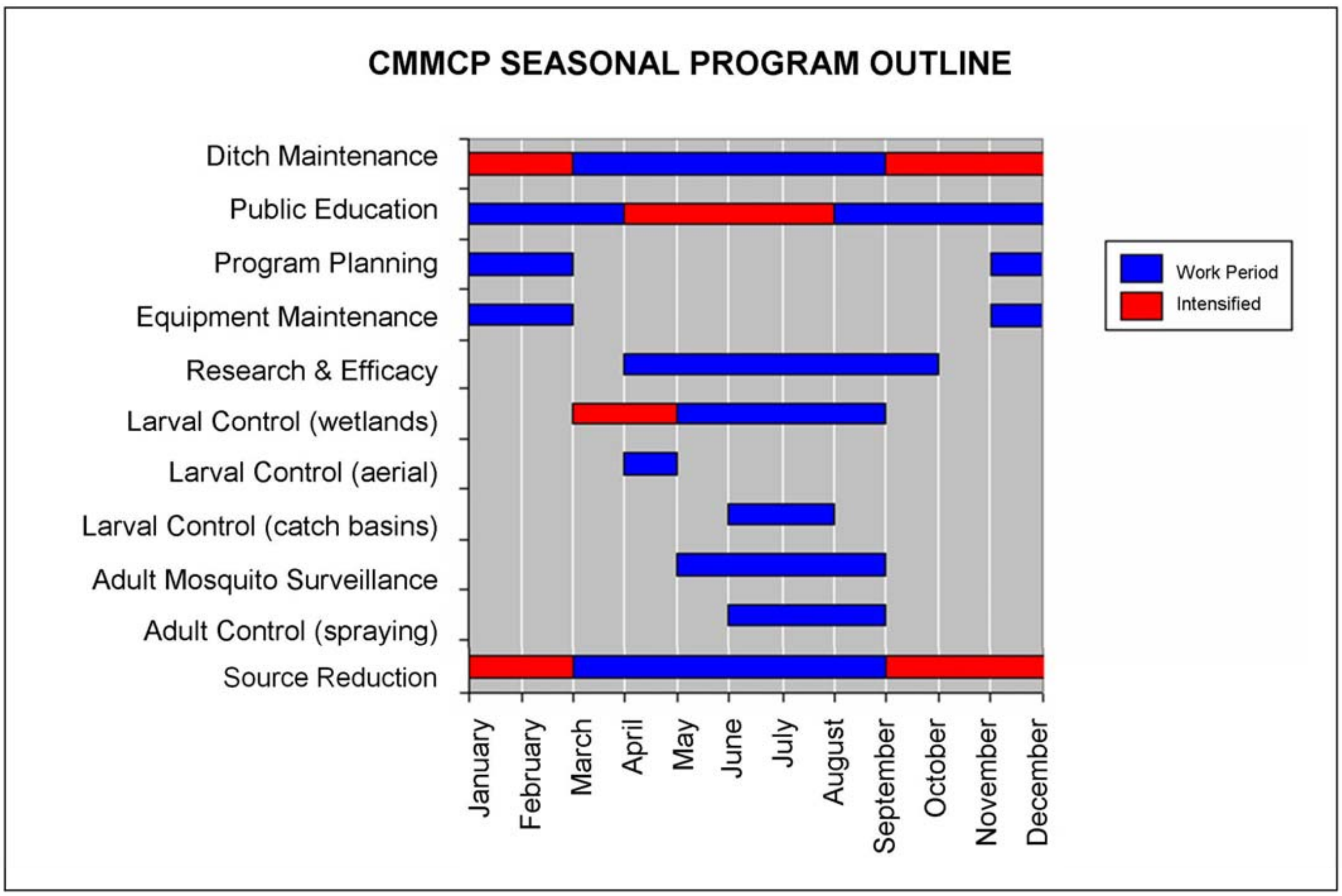
6. Larval Control (catch basins) - June through September

7. Adult mosquito Surveillance - May through September/October

8. Adulticiding - June through September/October

9. Source reduction - throughout the year, intensified September through February

Any mosquito control being done by individual member communities must, by law, be coordinated through the Central Massachusetts Mosquito Control Project.



SERVICES AND ACTIVITIES

The following services and activities are available to those communities participating in the Central Massachusetts Mosquito Control Project:

1. **LARVAL CONTROL**: Wetlands and suspected mosquito breeding sites are monitored from March through September to determine the need for applications of environmentally sensitive products (typically a bacteria called Bti) to control and/or eliminate the larval mosquito. By controlling mosquitoes in their larval stage the need for adult mosquito spraying is reduced.

2. **SOURCE REDUCTION**: Reducing or removing larval habitat by recycling, waste disposal or other means is a permanent solution. Mosquito larvae are opportunistic and will create habitat in any container that holds water for more than a week. Empty and clean birdbaths and kiddie pools each week, cover or store inside anything that may capture and hold water, and dispose of or recycle any containers that are no longer needed. CMMCP now has a tire recycling program to allow residents a means to dispose of these important larval habitats.

3. **WETLAND RESTORATION/DITCH MAINTENANCE**: Mosquitoes need still, stagnant water to complete their metamorphosis from egg to adult. CMMCP conducts maintenance on ditches, culverts and man-made ponds to improve water quality and increase water flow, reducing the potential for mosquito breeding.

4. **SURVEILLANCE**: Mosquito populations are monitored in both the larval and adult stages to determine the appropriate control methods to be employed, prevalent mosquito species, and disease transmission potential. CMMCP has instituted a program to supplement the Dept. of Public Health's arbovirus surveillance program for monitoring West Nile Virus in Massachusetts, using mosquito gravid traps. These traps will be placed throughout out service area and can be quickly broken down and moved to respond to the immediate needs of monitoring for this and other mosquito-borne diseases. When WNV or EEE is confirmed in a member city or town, these traps are placed in areas that have been determined to harbor this virus. Additional types of traps able to sample mammal-biting mosquitoes will also be placed to determine WNV levels and risk to the local populace.

5. **PUBLIC EDUCATION**: Educating the public about mosquitoes and their biology is an important aspect of our program. We offer a comprehensive program in member communities geared towards school-aged children from Kindergarten to High School. This program is tailored to meet the needs of intended audience. In 2011 we developed a specialized program geared towards senior citizens. The Project produces public relations handouts, and all member Town Halls are stocked with information on CMMCP, our programs, and how the homeowner can reduce mosquito populations in their own area. Project staff is available to meet with civic organizations, town/city boards, and to participate in Health Fairs. Tours of the Project's headquarters can be arranged by calling our office.

6. **ADULT MOSQUITO CONTROL**: When adult mosquito populations reach intolerable levels, hand-held or truck mounted sprayers are used to reduce the adult mosquito levels in residential areas. CMMCP has worked diligently over the past 20 years to achieve the goal of reducing the dependency on adulticiding by increasing the emphasis on larviciding, public education, water management and source reduction.

7. **BEAVER MITIGATION:** CMMCP receives many requests from city and town officials and property owners seeking assistance to alleviate flooding cause by beaver activity. CMMCP recognizes beavers as keystone species of the natural and ecological landscape. Beaver activity creates wetland and wildlife habitat that benefits many plant and animal species. Along with the positive aspects of beaver activity come some negative aspects. The most frequent issue affecting CMMCP is dam building activity which clogs culverts and drainage ditches. Increased flooding creates new habitat for mosquitoes and increases the need for Integrated Pest Management (IPM) techniques. CMMCP supports and follows the recommended practices for beaver management per the Massachusetts Division of Fisheries and Wildlife. Beaver activity will not be interrupted unless it becomes a threat to public health and safety per the Massachusetts Beaver Law M.G.L. c. 131 S. 80A. CMMCP will fully adhere to the permitting process as regulated by the Division of Fisheries and Wildlife (DFW) and the Department of Public Health (DPH).

8. **RESEARCH AND EFFICACY**: While CMMCP is an agency charged with the control of mosquitoes, we strive to check for efficacy of our products and techniques, and whenever possible perform research in new or different areas of mosquito control.

WETLANDS RESTORATION PROGRAM REPORT 2015

Wetland restoration is an important part of the CMMCP's Integrated Pest Management (IPM) plan for mosquito control. The intent of the program is to improve the flow of water in degraded drainage systems through ditch maintenance and wetland restoration projects. These projects will effectively reduce and prevent mosquito breeding sources and can reduce or often eliminate the need for periodic applications of pesticides.

Wetland restoration/water management projects are planned per the *Massachusetts Best Management Practices and Guidance for Freshwater Mosquito Control* and the *Mechanical Wetlands Management Activity Post-Monitoring Guidelines*. Wetlands projects are designed to minimize wetlands impacts.

Projects are initiated with a phone call from a town resident or town official. Also, a member from the CMMCP staff may identify a site that could benefit from work. Once a site is brought to the attention of CMMCP, the Wetland Project Coordinator performs an assessment of the site. If the site is appropriate for work, a site survey, site plan, and notifications are completed.

The site survey includes soil sampling, taking transects and cross sections of the ditch, and determining hydrological conditions. Wetlands are classified and sites are documented in the pre- and post- excavation states through a photographic record. Historical information on the drainage system is obtained from local residents or town records. The data gathered in the field is used in combination with information acquired from resources such as historical aerials and spatial data from the Commonwealth of Massachusetts Office of Geographic Information (MassGIS) online mapping program to develop a project site plan. The site plan includes project specifications which the field staff need in order to properly perform the project.

Once the site plan is completed, notification letters and permission slips are sent out to all property owners who would be affected by the project. In addition, notification letters are sent to MA DEP, the local conservation commission and the US Army Corps of Engineers for all mechanized work using a low ground pressure excavator. The notification letter provides a 30 day grace period. During this time, property owners and agencies have the opportunity to notify CMMCP of any concerns that they may have with a project. If there are legitimate concerns, a project may be modified, delayed or abandoned. If no issues are brought to the attention of CMMCP within the 30 day period, the project begins as planned.

The presence of beaver in the watershed has become an increasing concern for residents, town officials and CMMCP. Active beaver create beaver dams along streams and within wetland areas creating beaver ponds often resulting in flooding. Increase in flooding may cause health and safety issues for residents and municipalities. Increased flooding typically causes stagnant standing water which is prime mosquito habitat. CMMCP offers assistance and guidance relating to beaver management. CMMCP consults with local boards of health and conservation commissions to comply with state laws. CMMCP is in the practice of removing beaver dams, installing culvert protection and water flow devices on a case by case basis. Trapping is not a provided service at this time.

SUMMARY OF WORK FOR 2015:

In 2015, 87 sites were assessed by the Wetland Project Coordinator. Of these sites, 25 were visited multiple times to best survey, implement, and monitor water management work. Of the sites, 31 were brought to the attention of the Project through resident requests (36%), 21 sites were requested by town officials (25%), and 24 were identified by CMMCP staff (29%). Nine were requested from a combination of residents, officials, and/or CMMCP staff (10%). In addition, sixteen new sites were assessed with regard to new beaver complaints (18%).

Thirty-one water management jobs were set up and completed, with ongoing maintenance. Nine of these jobs involved the use of the low ground pressure excavator. All thirty-one jobs included hand work. One water flow device was installed to control the water level of a beaver pond. Three previously installed water flow devices were monitored for effectiveness. One of these was removed because health and safety was an imminent threat.

Additional information on our procedures or on specific restoration projects can be acquired by calling the CMMCP office at (508) 393-3055 from 7:00am to 3:30pm.

Respectfully submitted,

Katrina Proctor, Wetland Project Coordinator

SOURCE REDUCTION/TIRE RECYCLING REPORT 2015

For Earth Day 2010, CMMCP officially announced a tire recycling program added as a value added service to our member cities and towns. This program operates under grant monies received and the CMMCP operating budget. Tire piles provide suitable areas for larval mosquito development, including those species known to carry West Nile virus. During the course of one season, the potential exists for hundreds or even thousands of mosquitoes to emerge from just one tire. If tires infested with mosquito eggs, larvae or pupae are transported, the potential to introduce mosquito species into new areas and/or the potential for the spread of arboviruses and their transmission may increase significantly.
For these reasons and as a value added service to our member cites and towns, CMMCP has developed a used tire program, consisting of the following guidelines:

- We accept passenger and light truck tires only
- The maximum number tires from one property will be 10 at one time, subject to change without notice
- Requests for tire removal shall be done according to established procedures
- We reserve the right to refuse anything determined to be unsuitable for this program

Tires accepted as part of this program are sent to an approved facility for recycling or disposal. This program is subject to end without notice.

We have been removing tire piles in member cities and towns on an intermittent basis. If you know of a tire pile in your area, or would like to participate in a curbside pickup in the future, please send the following information to used_tires@cmmcp.org; NAME, ADDRESS, TOWN, PHONE, E-MAIL, # of TIRES (off the rim), LOCATION OF TIRES, ANY COMMENTS. When we schedule a curbside pickup event in your area you will be notified in advance.

ELIGIBILITY: to qualify for this program you must be a resident or municipal official in a CMMCP member city or town and the tires must be in or from that locality. Businesses are not eligible at this time.

COST: there is no additional cost to residents or municipalities; this program is part of the full suite of mosquito control services offered.

2015 Tire Collection Data:

In 2015 CMMCP collected and recycled 28.21 tons of tires. This year over 65% of the tires recycled by CMMCP originated from tire recycling events held throughout Central Massachusetts. The remainder of the recycling efforts originated from large tire recycling projects, residential tire removal, and roadside clean-ups. Since the inception of this tire program in 2010 CMMCP has recycled 172.78 tons of tires (this figure includes tire collected in the first month of 2016).

2015 TIRES COLLECTION DATA:

Town	Tires collected		Town	Tires collected
Ashland	91		Millbury	154
Billerica	211		Millville	10
Boxboro	6		Natick	38
Chelmsford	60		Northborough	39
Clinton	82		Shrewsbury	112
Dracut	174		Southborough	32
Fitchburg	594		Stow	25
Lancaster	260		Sturbridge	122
Leominster	258		Tewksbury	250
Lowell	3		Westborough	34
Lunenburg	117		Westford	64
Milford	85			

CMMCP MEDICAL ENTOMOLOGY LABORATORY REPORT, 2015

The mission of the Medical Entomology Laboratory is to refine and maximize the Central Massachusetts Mosquito Control Project's ongoing effort to control mosquitoes. During 2015 Medical Entomology Laboratory personnel carried this mission forward in the following ways.

The Staff Entomologist made 55 educational presentations before 2,210 elementary school students in 13 Elementary schools. The students learned about the life cycle and biology of mosquitoes. They also learned what they could do to control the mosquito population around their own home and how to protect themselves from nuisance mosquitoes.

During 2015, three technicians were employed for the season to operate the mosquito surveillance traps. Using their knowledge of mosquito behavior and the local terrain, these skilled and experienced personnel monitored the adult mosquito population. More than 1,600 collections were made during 2015.

Collections of mosquitoes were made using Modified Reiter Gravid Traps, BG Sentinel Traps and New Standard Miniature Light Traps. Modified Reiter Gravid Traps are attractive to *Culex* mosquito species. *Culex* species are implicated in the maintenance and transmission of West Nile virus in the United States of America. BG Sentinel traps are attractive to a mosquito species named *Aedes albopictus*. *Aedes albopictus,* commonly known as the "Asian Tiger Mosquito", is an invasive mosquito species that is threatening to make in roads into Massachusetts. The species is an aggressive daytime biter and has proven capable of carrying and transmitting a variety of viral diseases. New Standard Miniature Light Traps use light and/or carbon dioxide gas to attract the vectors of both West Nile and Eastern Equine Encephalitis. The addition of carbon dioxide gas results in larger collections. Eastern Equine Encephalitis is caused by a virus that has been found in a variety of mosquito species. Ongoing research implicates *Culiseta melanura*, as the most important vector of Eastern Equine virus. *Culiseta melanura* utilizes Red Maple swamps as a breeding habitat. Red Maple swamps are found throughout the CMMCP service area.

The collected mosquitoes were identified to species by the Staff Entomologist, Field Biologist and Summer Intern. Mosquito species known to play a role in the transmission of disease were set aside for further processing. During 2015, 33,810 mosquitoes representing 14 species were submitted for testing. For efficiency they were divided into 1,319 groups or pools. These pools of mosquitoes were tested for West Nile virus and Eastern Equine virus infection. Of the 1,319 pools tested ten proved positive for West Nile virus and one proved positive for Eastern Equine virus. The findings are listed below.

In response to the positive test results the CMMCP increased surveillance of mosquitoes in these areas. Mosquito control measures were augmented as well. The data from these collections was shared with the Massachusetts Department of Public Health.

Modern, scientifically based mosquito control has many facets. These include public education, surveillance, water management and control of immature and adult mosquitoes. Medical Entomology Laboratory personnel are committed to advancing all facets of mosquito control. Such a commitment will further enable the Central Massachusetts Mosquito Control Project to provide its member communities with quality mosquito control.

Respectfully submitted,

Curtis R. Best
Staff Entomologist

ARBOVIRUS SURVEILLANCE RESULTS - CMMCP

COLLECTION DATE	SPECIES	TOWN	TEST TYPE	RESULT
8/27/2015	*Culex spp.*	Hudson	WNV	Positive
9/4/2015	*Culex spp.*	Lowell	WNV	Positive
9/9/2015	*Culex spp.*	Millbury	WNV	Positive
9/10/2015	*Culex spp.*	Millville	WNV	Positive
9/17/2015	*Culex spp.*	Millbury	WNV	Positive
9/17/2015	*Culex spp.*	Natick	WNV	Positive
9/17/2015	*Culex spp.*	Sherborn	WNV	Positive
9/18/2015	*Culex spp.*	Northbridge	WNV	Positive
9/22/2015	*Culex spp.*	Wilmington	WNV	Positive
9/25/2015	*Culex spp.*	Northbridge	EEE	Positive
9/30/2015	*Cs. melanura*	Westborough	WNV	Positive

CMMCP Surveillance Summary	2015
Mosquitoes collected & tested	33,810
Mosquito pools submitted for testing	1,319
Mosquito pools positive for WNv	10
Mosquito pools positive for EEv	1
WNv Surveillance Summary – Statewide	**2015**
Mosquito pools positive	164
Animals positive	0
Humans positive	9
EEv Surveillance Summary – Statewide	**2015**
Mosquito pools positive	1
Animals positive	0
Humans positive	0

Stow Surveillance Data
2015

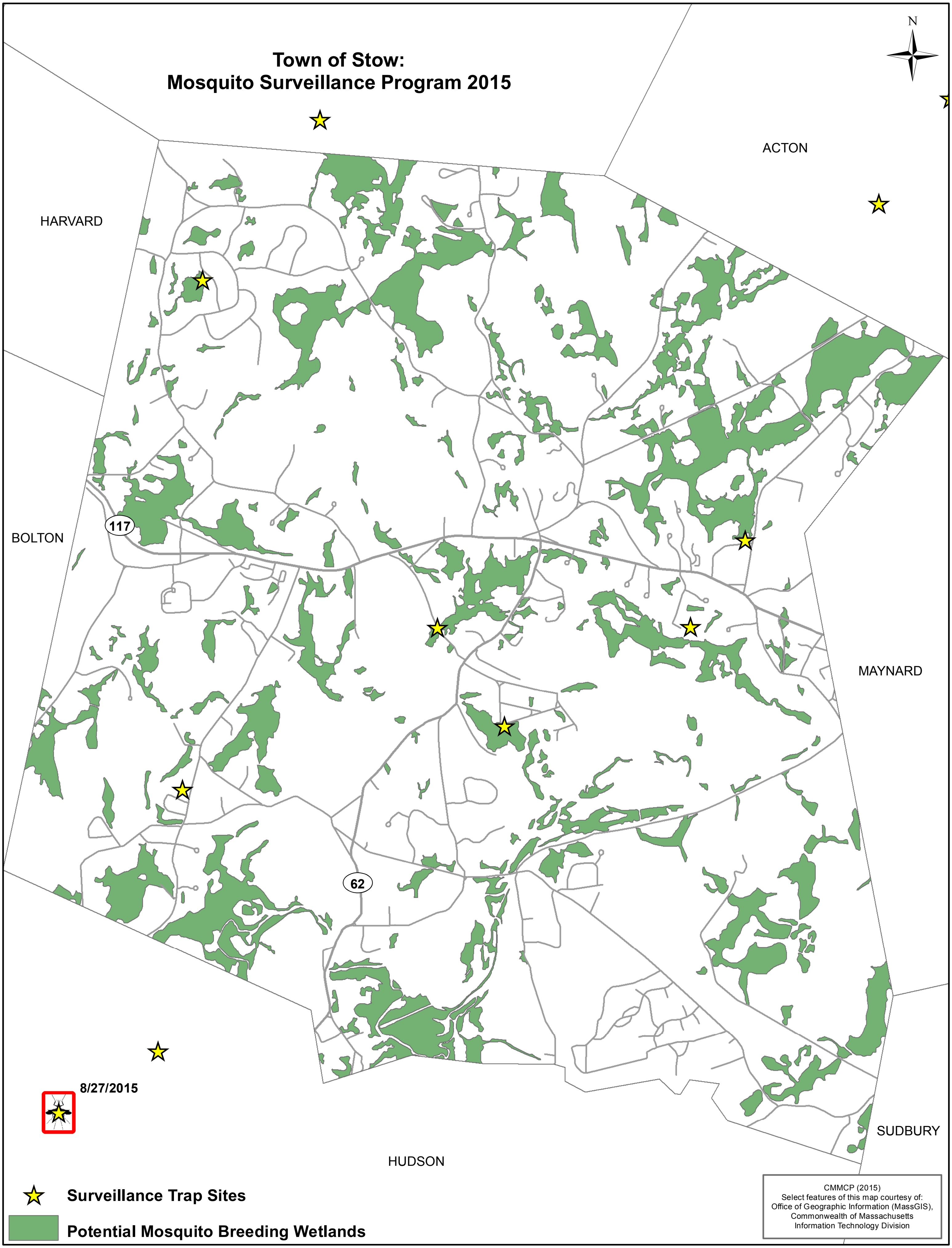
Town	Pool ID	Collection Date	Trap Site	Pool Size	Species	Result
Stow	CM15NS-0179	6/3/2015	Bradley Ln.	0	No Collections Recorded	Not submitted
Stow	CM15NS-0225	6/4/2015	Samuel Prescott Rd.	68	*Oc. stimulans*	Not submitted
Stow	CM15NS-0226	6/4/2015	Samuel Prescott Rd.	151	*Oc. abserratus*	Not submitted
Stow	CM15NS-0227	6/4/2015	Samuel Prescott Rd.	48	*Oc. canadensis*	Not submitted
Stow	CM15NS-0228	6/4/2015	Samuel Prescott Rd.	20	*An. punctipennis*	Not submitted
Stow	CM15NS-0229	6/4/2015	Samuel Prescott Rd.	4	*Cs. melanura*	Not submitted
Stow	CM15NS-0230	6/4/2015	Samuel Prescott Rd.	37	*Oc. excrucians*	Not submitted
Stow	CM15NS-0231	6/4/2015	Samuel Prescott Rd.	2	*An. quadrimaculatus sl*	Not submitted
Stow	CM15NS-0232	6/4/2015	Samuel Prescott Rd.	3	*Culex pipiens/restuans*	Not submitted
Stow	CM15NS-0233	6/4/2015	Samuel Prescott Rd.	1	*Ae. vexans*	Not submitted
Stow	CM15NS-0343	6/10/2015	Wheeler Rd.	1	*Oc. japonicus*	Not submitted
Stow	CM15NS-0344	6/10/2015	Wheeler Rd.	2	*Culex pipiens/restuans*	Not submitted
Stow	CM15-0039	6/11/2015	Conant Dr.	50	*Cq. perturbans*	Negative
Stow	CM15-0040	6/11/2015	Conant Dr.	12	*Oc. canadensis*	Negative
Stow	CM15-0128	6/18/2015	Samuel Prescott Rd.	35	*Cq. perturbans*	Negative
Stow	CM15-0129	6/18/2015	Samuel Prescott Rd.	50	*Oc. canadensis*	Negative
Stow	CM15-0192	6/24/2015	Sandy Brook Dr.	24	*Culex pipiens/restuans*	Negative
Stow	CM15-0218	6/25/2015	Bradley Ln.	10	*Cq. perturbans*	Negative
Stow	CM15-0303	7/2/2015	Samuel Prescott Rd.	11	*Culex pipiens/restuans*	Negative
Stow	CM15NS-0857	7/2/2015	Samuel Prescott Rd.	1	*An. barberi*	Not submitted
Stow	CM15NS-0869	7/2/2015	Circuit Dr.	954	*Cq. perturbans*	Not submitted
Stow	CM15NS-0870	7/2/2015	Circuit Dr.	3	*Oc. excrucians*	Not submitted
Stow	CM15NS-0871	7/2/2015	Circuit Dr.	3	*Culex pipiens/restuans*	Not submitted
Stow	CM15NS-0872	7/2/2015	Circuit Dr.	12	*An. punctipennis*	Not submitted
Stow	CM15NS-0873	7/2/2015	Circuit Dr.	27	*Oc. canadensis*	Not submitted
Stow	CM15NS-0874	7/2/2015	Circuit Dr.	12	*An. quadrimaculatus sl*	Not submitted
Stow	CM15NS-0875	7/2/2015	Circuit Dr.	6	*Ae. vexans*	Not submitted
Stow	CM15NS-0876	7/2/2015	Circuit Dr.	6	*Ae. cinereus*	Not submitted
Stow	CM15-0370	7/9/2015	Wheeler Rd.	11	*Culex pipiens/restuans*	Negative
Stow	CM15-0373	7/9/2015	Conant Dr.	50	*Cq. perturbans*	Negative
Stow	CM15-0458	7/16/2015	Bradley Ln.	6	*Oc. triseriatus*	Negative
Stow	CM15-0459	7/16/2015	Sandy Brook Dr.	50	*Cq. perturbans*	Negative

Stow Surveillance Data
2015

Town	Pool ID	Collection Date	Trap Site	Pool Size	Species	Result
Stow	CM15-0310	7/20/2015	Circuit Dr.	50	*Cq. perturbans*	Negative
Stow	CM15-0527	7/23/2015	Circuit Dr.	14	*Culex pipiens/restuans*	Negative
Stow	CM15-0530	7/23/2015	Samuel Prescott Rd.	50	*Cq. perturbans*	Negative
Stow	CM15-0608	7/30/2015	Conant Dr.	16	*Culex pipiens/restuans*	Negative
Stow	CM15-0616	7/30/2015	Wheeler Rd.	50	*Cq. perturbans*	Negative
Stow	CM15-0687	8/6/2015	Sandy Brook Dr.	5	*Oc. japonicus*	Negative
Stow	CM15-0693	8/6/2015	Bradley Ln.	50	*Cq. perturbans*	Negative
Stow	CM15-0805	8/13/2015	Samuel Prescott Rd.	8	*Oc. triseriatus*	Negative
Stow	CM15-0806	8/13/2015	Circuit Dr.	50	*Cq. perturbans*	Negative
Stow	CM15-0911	8/21/2015	Conant Dr.	50	*Cq. perturbans*	Negative
Stow	CM15-0912	8/21/2015	Conant Dr.	50	*Cq. perturbans*	Negative
Stow	CM15-0913	8/21/2015	Conant Dr.	50	*Cq. perturbans*	Negative
Stow	CM15-0914	8/21/2015	Conant Dr.	50	*Cq. perturbans*	Negative
Stow	CM15-0915	8/21/2015	Conant Dr.	50	*Cq. perturbans*	Negative
Stow	CM15-0980	8/27/2015	Bradley Ln.	8	*Culex pipiens/restuans*	Negative
Stow	CM15-0981	8/27/2015	Bradley Ln.	5	*Oc. triseriatus*	Negative
Stow	CM15-0982	8/27/2015	Sandy Brook Dr.	7	*Cq. perturbans*	Negative
Stow	CM15-0983	8/27/2015	Sandy Brook Dr.	8	*Ae. vexans*	Negative
Stow	CM15-1090	9/3/2015	Circuit Dr.	14	*Culex pipiens/restuans*	Negative
Stow	CM15-1091	9/3/2015	Samuel Prescott Rd.	9	*Ae. vexans*	Negative
Stow	CM15NS-2274	9/3/2015	Samuel Prescott Rd.	3	*Psorophora ferox*	Not submitted
Stow	CM15NS-2275	9/3/2015	Samuel Prescott Rd.	10	*An. punctipennis*	Not submitted
Stow	CM15NS-2276	9/3/2015	Samuel Prescott Rd.	2	*An. quadrimaculatus sl*	Not submitted
Stow	CM15NS-2277	9/3/2015	Samuel Prescott Rd.	8	*Oc. canadensis*	Not submitted
Stow	CM15NS-2278	9/3/2015	Samuel Prescott Rd.	4	*Cq. perturbans*	Not submitted
Stow	CM15NS-2279	9/3/2015	Samuel Prescott Rd.	3	*Oc. triseriatus*	Not submitted
Stow	CM15NS-2280	9/3/2015	Circuit Dr.	2	*Uranotaenia sapphirina*	Not submitted
Stow	CM15-1146	9/11/2015	Wheeler Rd.	8	*Culex pipiens/restuans*	Negative
Stow	CM15NS-2498	9/11/2015	Conant Dr.	1	*Oc. triseriatus*	Not submitted
Stow	CM15NS-2499	9/11/2015	Conant Dr.	4	*Oc. japonicus*	Not submitted
Stow	CM15NS-2500	9/11/2015	Conant Dr.	4	*Culex pipiens/restuans*	Not submitted
Stow	CM15NS-2501	9/11/2015	Wheeler Rd.	4	*An. punctipennis*	Not submitted

Stow Surveillance Data
2015

Town	Pool ID	Collection Date	Trap Site	Pool Size	Species	Result
Stow	CM15NS-2502	9/11/2015	Wheeler Rd.	2	*Cq. perturbans*	Not submitted
Stow	CM15-1198	9/17/2015	Sandy Brook Dr.	6	*Oc. triseriatus*	Negative
Stow	CM15-1200	9/17/2015	Bradley Ln.	5	*Culex pipiens/restuans*	Negative
Stow	CM15NS-2744	9/24/2015	Samuel Prescott Rd.	0	No Collections Recorded	Not submitted
Stow	CM15NS-2745	9/24/2015	Circuit Dr.	1	*Ae. vexans*	Not submitted
Stow	CM15-1286	10/1/2015	Wheeler Rd.	5	*Oc. japonicus*	Negative
Stow	CM15NS-2855	10/2/2015	Conant Dr.	1	*Cq. perturbans*	Not submitted
Stow	CM15NS-2856	10/2/2015	Conant Dr.	1	*Culex pipiens/restuans*	Not submitted
Stow	CM15NS-2971	10/8/2015	Bradley Ln.	2	*Oc. japonicus*	Not submitted
Stow	CM15NS-2972	10/8/2015	Sandy Brook Dr.	1	*An. punctipennis*	Not submitted
Stow	CM15NS-2973	10/8/2015	Sandy Brook Dr.	1	*Culex pipiens/restuans*	Not submitted
Stow	CM15NS-2974	10/8/2015	Sandy Brook Dr.	1	*Cs. melanura*	Not submitted
	76	**collections**		**2343**	**mosquitoes collected**	
	35	**collections submitted for testing**		**927**	**submitted for testing**	



Town of Stow:
Mosquito Surveillance Program 2015
N
ACTON
HARVARD
BOLTON
117
MAYNARD
62
8/27/2015
HUDSON
SUDBURY
Surveillance Trap Sites
Potential Mosquito Breeding Wetlands
CMMCP (2015)
Select features of this map courtesy of:
Office of Geographic Information (MassGIS),
Commonwealth of Massachusetts
Information Technology Division

STAFF BIOLOGIST REPORT 2015

There were several investigations undertook by the Department in 2015, highlighted by the field evaluation of Zenivex® E20 (EPA Reg. No. 2724-791) a relatively novel ultra-low volume (ULV) adulticide product. This efficacy trial also involved a comparison component with Anvil® 10+10 (EPA Reg. No. 1021-1688-8329), the current ULV adulticide product utilized by CMMCP. The active ingredient (AI) in Zenivex® E20 is etofenprox, while the AI in ANVIL® 10+10 is sumithrin. Although both Zenivex® E20 and ANVIL® 10+10 both utilize synthetic pyrethroids, Zenivex® E20 has the advantage of not including the synergist piperonyl butoxide. Mosquito surveillance prior to and following the applications of these two adulticides indicate that there was no significant difference in level of control achieved.

Resistance surveillance continued in 2015, focusing on Anvil® 10+10 and not Zenivex® E20. This was due in part to the historical data CMMCP has accrued for Anvil® 10+10 resistance and the limited use of Zenivex® E20 by the Project. The data from this season has indicated that no change in protocol is needed regarding the use of Anvil® 10+10 by CMMCP. An article on this program was published in the Spring 2015 issue (Vol. 26, No. 1) of *Wing Beats* entitled "Bottle Bioassays Test Resistance to Sumithrin in Central Massachusetts." The article gave an overview of the CMMCP program and will hopefully encourage other mosquito control organizations to start conducting their own local resistance surveillance.

Surveillance of *Coquillettidia perturbans* continued around cattail ponds, some pretreated with Natular™ G (EPA Reg. No. 8329-80) while others used as untreated controls. Natular™ G differs from some larvicides in that the active ingredient is spinosad, derived from the fermentation of the soil organism *Saccharopolyspora spinosa*. Other biological larvicides tend to utilize compounds from *Bacillus sphaericus* and/or *Bacillus thuringiensis israelensis*. The results of this trial were inconclusive, with a couple possible issues. Either the product and/or application was ineffective or the surveillance method of free standing CDC traps was not representative. This will be addressed with the use of emergence traps which will directly monitor the *Cq. perturbans* at the treated and untreated areas.

Another formulation of spinosad, Natular™ G30 (EPA Reg. No. 8329-83), was used to pretreat woodland pools against early season species such as Ochler*otatus abserratus, Oc. excrucians,* and *Oc. canadensis*. Unlike Natular™ G, Natular™ G30 is designed to slowly release spinosad particles for up to 30 days. Many frozen or partially frozen woodland pools were treated with the Natular™ G30, with a few untreated for use as controls. Larval development was monitored at all sites approximately twice a week until pupae were observed, signifying a failure. Significant control was achieved in a subset of treatment sites, whiles others exhibited delayed but ultimately full development of the larvae present. This evaluation of Natular™ G30 as a pre-hatch control option for early season species will be continued in 2016 with an expanded number of control sites to determine if this is a viable tool for spring brood pre-hatch control.

The Overnia Captivector™ CO_2 generation device was evaluated once again in comparison to a standard compressed CO_2 source. Mosquito surveillance traps were run simultaneously at different locations on the CMMCP grounds. One trap was baited with the Overnia Captivector™, while the other with a standard CO_2 gas cylinder. These CO_2 sources were randomly rotated between the trap sites over the course of the season. Collections were counted and mosquito species identified for each gas source. The experience gained this season will be incorporated into future modifications of the Overnia Captivector™. Analysis has indicated that there is not a significant difference between the mosquito collections from traps using CO_2 from the Overnia Captivector™ and those baited with traditional compressed CO_2. This data will be presented at the 2016 annual meeting of the American Mosquito Control Association, held in Savannah, Georgia.

Additional endeavors by the Department included a continuation of The Mosquito Education Program for Seniors, with presentations being held at the Billerica, Milford, and Northbridge senior centers. All of these public education opportunities were well attended by engaged and enthusiastic residents. These presentations will continue next season and will be offered to municipalities of the CMMCP service area that have not hosted the event before. The informational booklet that accompanies The Mosquito Education Program for Seniors presentations will also be distributed to all CMMCP communities.

There are several research opportunities anticipated for the 2016 season. The CMMCP efficacy trials of Anvil® 10+10 will now potentially utilize mosquito field cages. This should provide a better indication of the impact upon the mosquito population present at the time of application. Alongside these efficacy trials will be resistance surveillance to ensure continued effectiveness of this product to local mosquitoes. The surveillance of *Cq. perturbans* following larvicide treatments will now be conducted using CMMCP constructed emergence traps, which should be more indicative of treatment success level. Continued evaluation of Natular™ G30 as a pre-hatch treatment will continue this season as well as the further evaluation of the Overnia Captivector™ CO_2 generation device.

Respectfully submitted,

Frank H. Cornine III, Staff Biologist

Bottle Assays of Field Collected Mosquitoes for Level of Resistance to ANVIL® 10+10 in Central Massachusetts (Update 2015)

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ABSTRACT

In 2015 the Central Mass. Mosquito Control Project continued conducting bottle bioassays, which test the potency of a substance on live specimens, to determine if pesticide resistance has been developing in local mosquito populations. Using procedures recommended by the Center for Disease Control and Prevention, the results of unexposed mosquitoes were compared to those collected from areas serviced by the CMMCP adulticide program. This was the ninth season of resistance surveillance by CMMCP in this manner. It was determined that the level of resistance in local mosquito populations does not warrant any procedural or insecticide changes at this time. Despite these findings, CMMCP will continue bottle assays of local mosquito populations to monitor the levels of resistance so that if indications of resistance are observed, proper actions could be implemented to ensure control effectiveness.

INTRODUCTION

With environmental changes, mosquito species have the potential to change their current distribution and bring disease with them to new areas (Brogdon 1998; Simsek 2003). These possible diseases include malaria, dengue, yellow fever and Rift Valley Fever among others (McAbee 2003; Simsek 2003). Faced with these new threats, vector control personnel must be aware of the dynamics of local mosquito species in order to lessen the threat of human infections.

Resistance to pesticides can have a major impact on the abilities of public health officials against vector-borne disease (Brogdon 1998). It has been shown that some past agricultural and pest control use of insecticides has led to the development of resistance of these chemicals in select populations of mosquitoes (Rodriguez 2005). This resistance is predicted to be the basis for future reemergence of vector-borne diseases, and also impair the control efforts in these situations (Brogdon 1998).

There are several factors that may have contributed to this development, including the narrowing scope of insecticides available for public health use, along with increasing restrictions from regulatory agencies (Brogdon 1998). Resistance to pyrethroids in particular could be due in part to past use of DDT in some areas, with the resistance mechanism being similar for both (Brogdon 1998; McAbee 2003). This cross-resistance, as observed between pyrethroids and DDT, is becoming more prevalent as the existing resistance mechanisms are being enhanced in the target insects (Brogdon 1998).

Despite research that has shown resistance in specific mosquito species, the actual impact of this on vector control is not known due to several issues. One is the lack of information about the current resistance levels, due in part to the wide variety of surveillance programs and data collection efforts. Another factor, and potentially more important, is that resistance seems to be localized. In one study, certain mosquito populations that were only a few kilometers apart varied greatly on the presence and levels of resistance, including the actual mechanism for the resistance (Brogdon 1998).

These unknowns about the level of resistance in vector species have reinforced the need to study pesticide resistance by CMMCP. The goals of this research will be to create baseline data for control efforts, detect early resistance, and to observe the current effects of control strategies (Brogdon 1998). If resistance is observed, then a change in application rates or a change to a different class of insecticides may need to be considered if possible.

To control adult mosquitoes, CMMCP uses ANVIL® 10+10 (Clarke Mosquito Control Products, Inc., Roselle, IL) (EPA Reg. No. 1021-1688-8329), a synthetic pyrethroid composed of 10% SUMITHRIN® (Sumitomo Chemical Company, Ltd., Osaka, Japan)(d-phenothrin) and 10% piperonyl butoxide (PBO)(CDC 2010; Petersen 2004), which is used as a synergist[1]. In this ongoing study to monitor resistance levels in its service area, CMMCP continued conducting bottle assays in the summer of 2015 for ANVIL® 10+10.

METHODS

The bottle assay procedure used by CMMCP was modeled after the CDC method (CDC 2010), where a baseline for resistance is established using specimens collected from an area without any historical adulticide exposure. This data could then be plotted against data from mosquito populations in areas where CMMCP records show past insecticide usage has occurred. This will determine if any degree of resistance has developed to the current CMMCP adulticide product.

To start, clean 250ml Wheaton bottles (Wheaton Science Products, Millville, NJ) were lined with 1ml of various concentrations of ANVIL® 10+10 (8.868μg/ml, 22.17μg/ml, 44.34μg/ml, and 88.68μg/ml), which were diluted with pesticide grade

[1]Synergist- Additional substance that will assist in the elimination of certain resistance mechanisms; PBO synergist eliminates oxidase activity (Center for Disease Control and Prevention 2002).

acetone (Thermo Fisher Scientific, Inc., Fair Lawn, NJ). Approximately 10-15 field collected mosquitoes were introduced into each bottle by mechanical aspiration and % knockdown was recorded at 5 minute intervals, up to 100% knockdown. For control bottles lined with only acetone (zero ANVIL® 10+10), % knockdown was observed at 5 minute intervals up to an hour. Each pesticide concentration assay had several trials until a concentration was found that created a timely morality curve that reached total knockdown around 30 minutes. Once the ANVIL® 10+10 baseline concentration was determined, it could be used against the exposed mosquito populations, with control bottles running simultaneously.

The collection of mosquitoes for the bottle assays were facilitated by the use of several CDC light traps (John W. Hock Co., Gainesville, FL), baited with CO_2 at a flow rate of 500ml/min. ABC standard collection nets (Clarke Mosquito Control Products, Inc., Roselle, IL) were used to contain the mosquitoes, along with a simple food source, until resistance testing took place, which was usually within a couple of hours. The mechanical aspiration from the collection cages to the assay bottles was enabled by the use of a flashlight aspirator (BioQuip Products, Inc., Rancho Dominguez, CA).

The baseline mosquitoes were collected from an area located near an organic farm. This site has been an official exclusion property since 2006, but even prior to that CMMCP has no record of using adulticide products there. Once the baseline concentration had been determined using these unexposed mosquitoes, collections were made at several other sites that had varying number of adulticide events (~2-15) over the previous couple of years. These potentially resistant mosquitoes were then run against the baseline concentration from the unexposed population, as well as control bottles coated with only acetone. Over the past eight seasons of resistance surveillance, several collection sites have been used, with slight modifications year to year depending on habitat and seasonal population changes.

After conducting bottle assays on the collected mosquitoes against the baseline concentration, the knockdown percentage was plotted against the time interval to determine if any degree of resistance was forming in these populations compared to those unexposed. If any specimens survived longer than those of the baseline group, this could represent some degree of resistance has developed.

RESULTS

The baseline component of the bottle assays that resulted in the optimal concentration of the ANVIL® 10+10 was 22.17µg/ml, which corresponded with data from previous studies (Petersen 2004). Using this concentration, it was found that in 2007 only one assay of eight trial sets had specimens that did not reach 100% knockdown before the 25 minute mark. This particular site, Haskell Street, had an average of 98.9% knockdown at the

25 minute mark, and by the next time interval did reach 100% knockdown. Both Otis Street locations had a slower curve than the rest of the sites, although they still reached 100% knockdown at 25 minutes like the baseline population. As one would expect, the control bottles coated with only acetone had zero knockdown effect (Figures 1, 2).

Figure 1: 2007 Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17µg/ml)

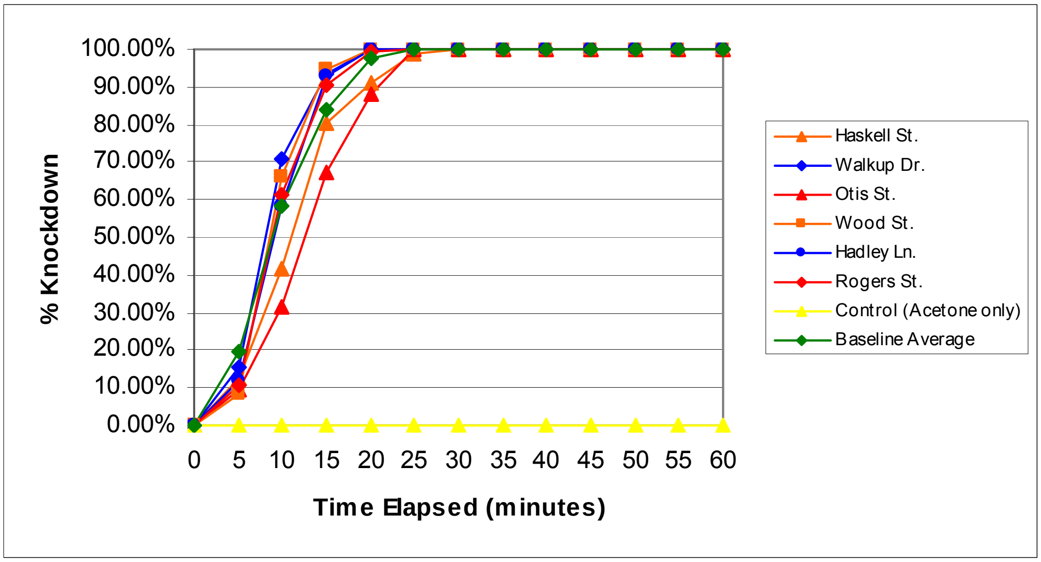
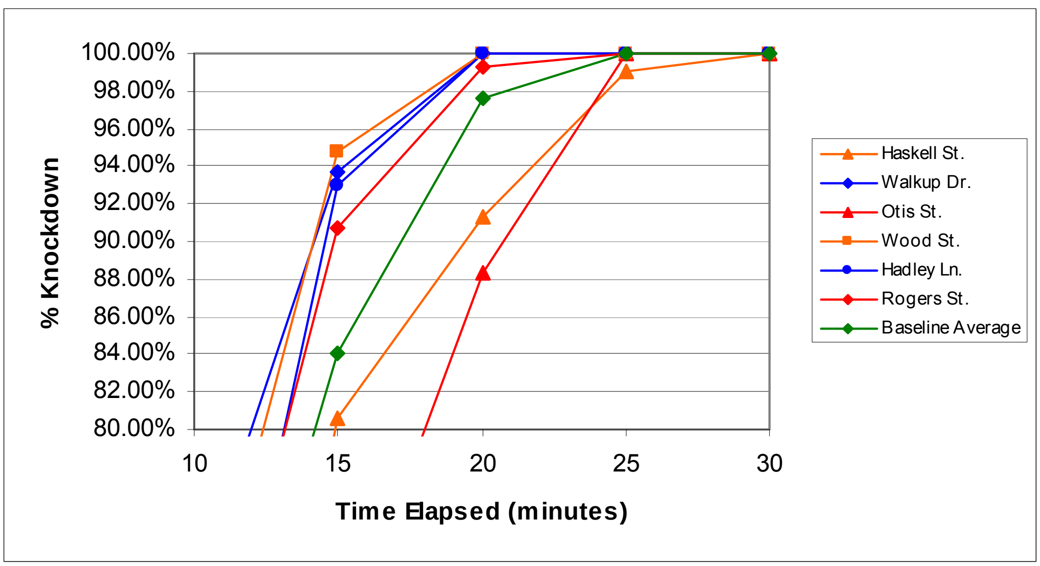


Figure 2: 2007 Time-% Knockdown Curves of Bottle Assays (2) for ANVIL® 10+10 (22.17µg/ml)



The bottle assays preformed in 2008 resulted in similar findings to 2007. Of the 13 trial sets, 6 had specimens that did not reach 100% knockdown by the 25 minute mark. However, these findings were not significant and all had knockdown rates at the 25 minute mark of over 97.22%. Again, the acetone only coated bottles had zero knockdown effect (Figure 3).

Figure 3: 2008 Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17µg/ml)

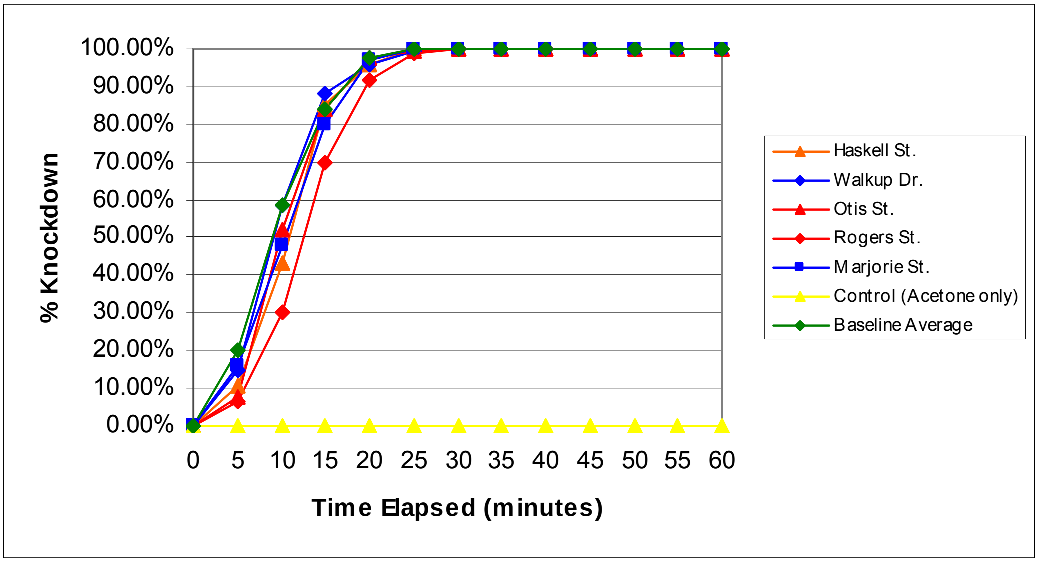
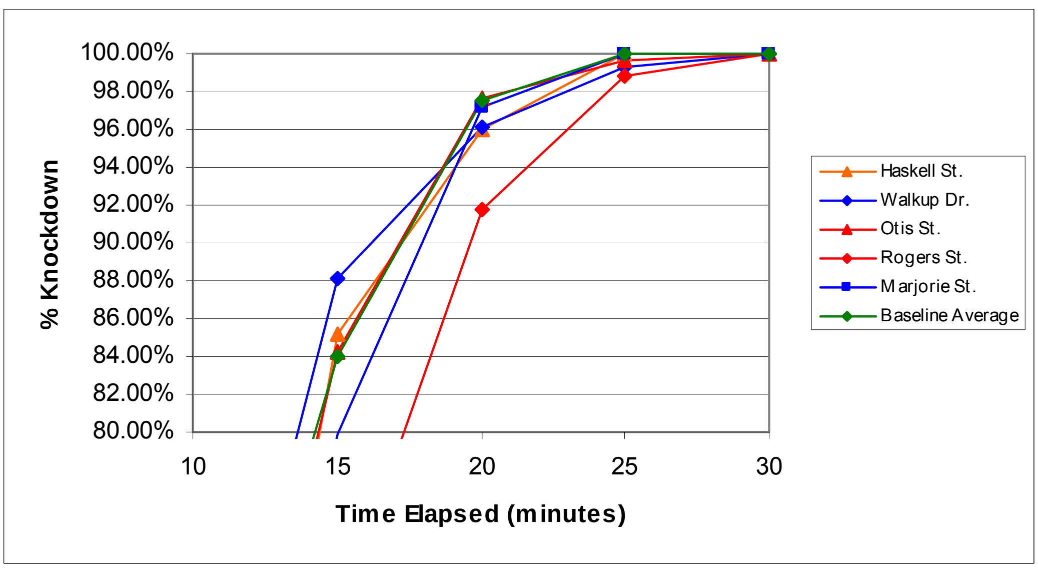


Figure 4: 2008 Time-% Knockdown Curves of Bottle Assays (2) for ANVIL® 10+10 (22.17µg/ml)



Bottle assays preformed in 2009 had trials where the specimens did not reach complete knockdown until the 35 minute mark (Figures 5, 6). Of all specimens tested in the 2009 trials, 99.72% of specimens were knocked down at the 30 minute mark or earlier. As with previous seasons, the acetone only coated bottles had zero knockdown effect (Figure 5).

Figure 5: 2009 Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17µg/ml)

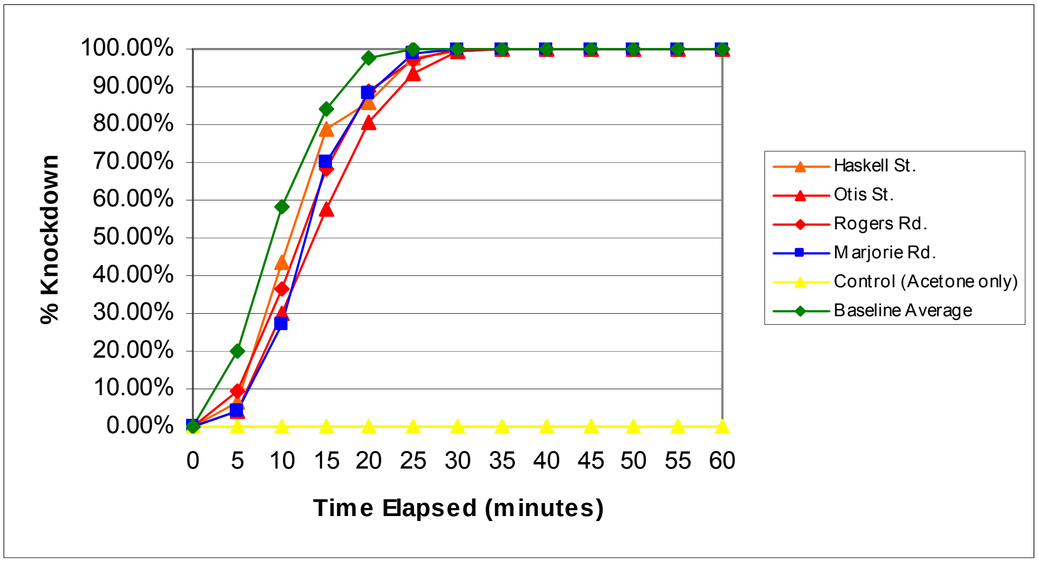
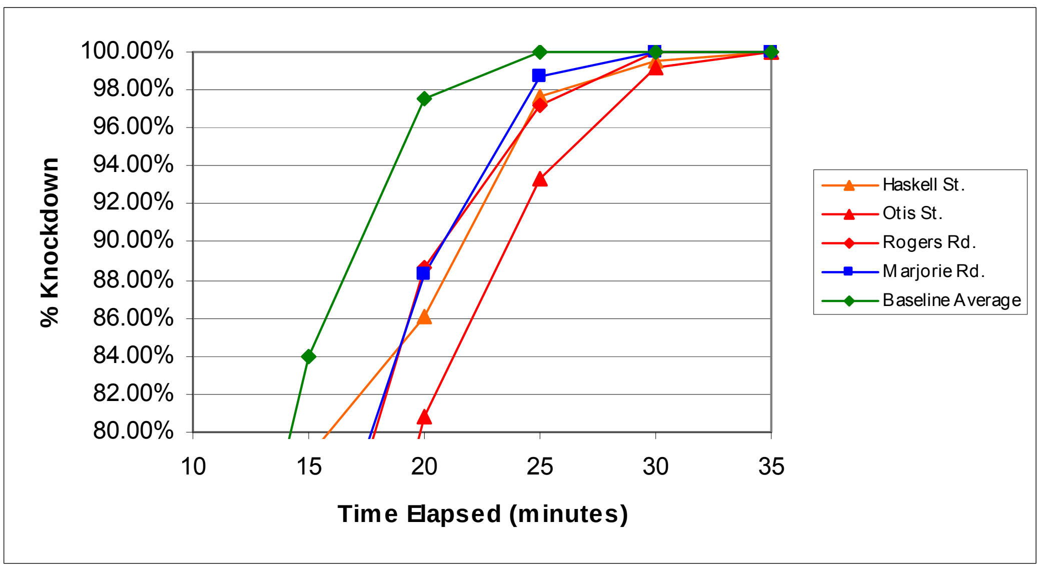


Figure 6: 2009 Time-% Knockdown Curves of Bottle Assays (2) for ANVIL® 10+10 (22.17µg/ml)



The bottle assays performed in 2010 showed an increase in the knockdown rate compared to the previous year (Figures 7, 8). At the 20, 25, and 30 minute mark, the knockdown percentages were 98.52%, 99.86%, and 100% of the specimens respectively. This rate is more consistent with the baseline average and also with the trials conducted in 2007 and 2008. The acetone only control exhibited zero knockdown effect on the specimens (Figure 7).

Figure 7: 2010 Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17µg/ml)

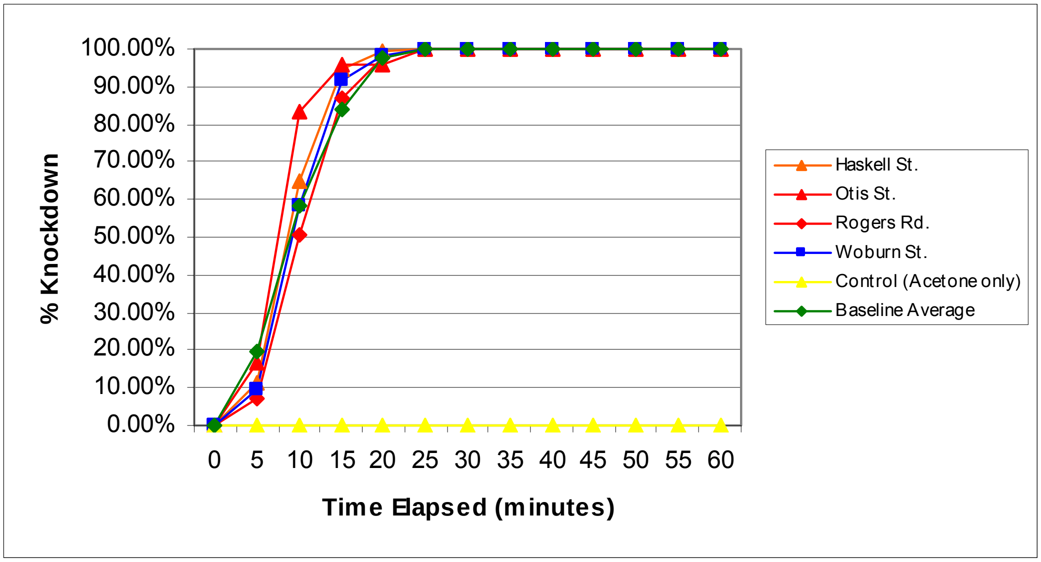
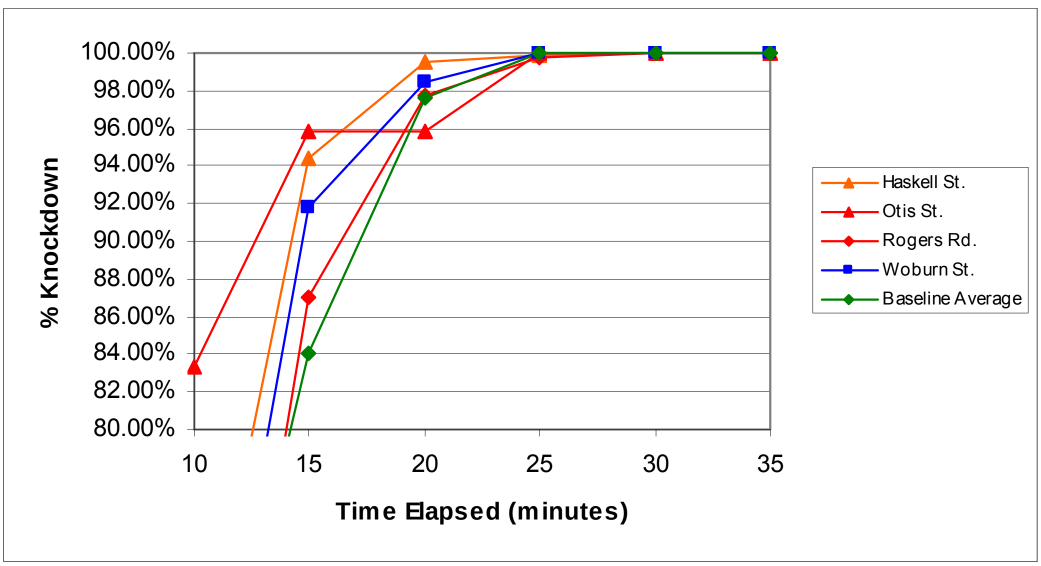


Figure 8: 2010 Time-% Knockdown Curves of Bottle Assays (2) for ANVIL® 10+10 (22.17μg/ml)



The 2011 bottle assays were very similar to the previous year, with all sites within the spectrum of the baseline average (Figures 9, 10). Overall, all of the specimens were knocked down by the 30 minute mark, with 97.60% and 99.69% down at the 20 and 25 minute marks respectively. The control bottles coated with acetone alone had zero knockdown effect as one would expect (Figure 9).

Figure 9: 2011 Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17µg/ml)

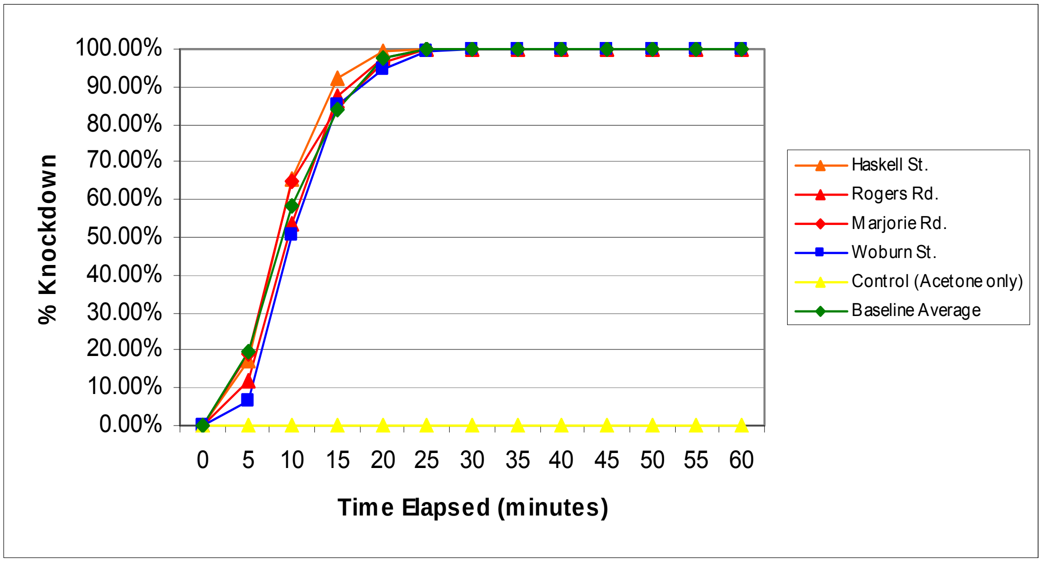
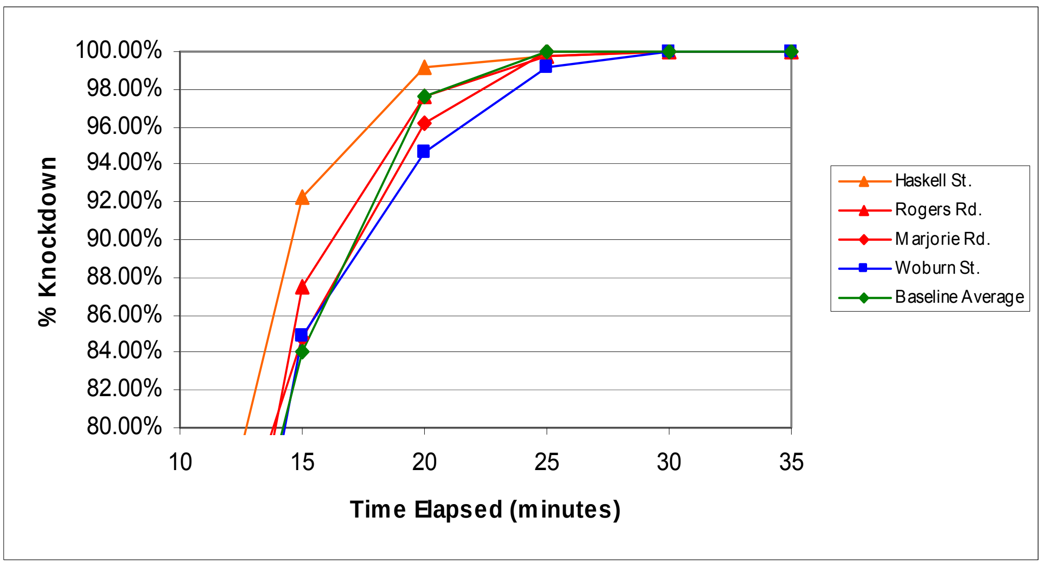


Figure 10: 2011 Time-% Knockdown Curves of Bottle Assays (2) for ANVIL® 10+10 (22.17µg/ml)



The bottle assay results from the 2012 season continued to reflect the baseline averages (Figures 11, 12). Overall, 99.94% of the specimens were knocked down by the 30 minute mark, with 96.23% and 99.74% down at the 20 and 25 minute marks respectively. The acetone only coated bottles had zero knockdown effect (Figure 11).

Figure 11: 2012 Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17μg/ml)

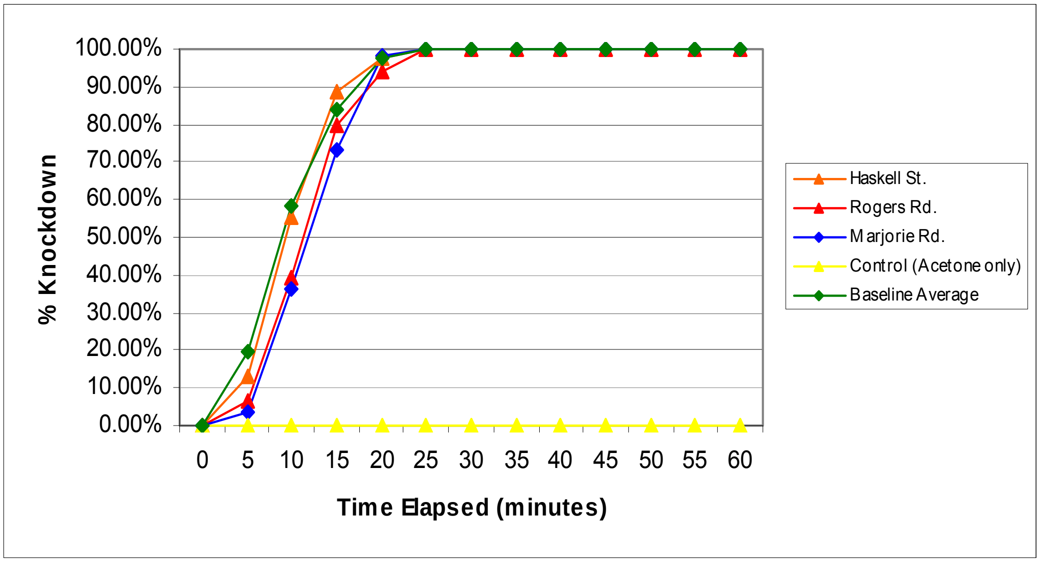
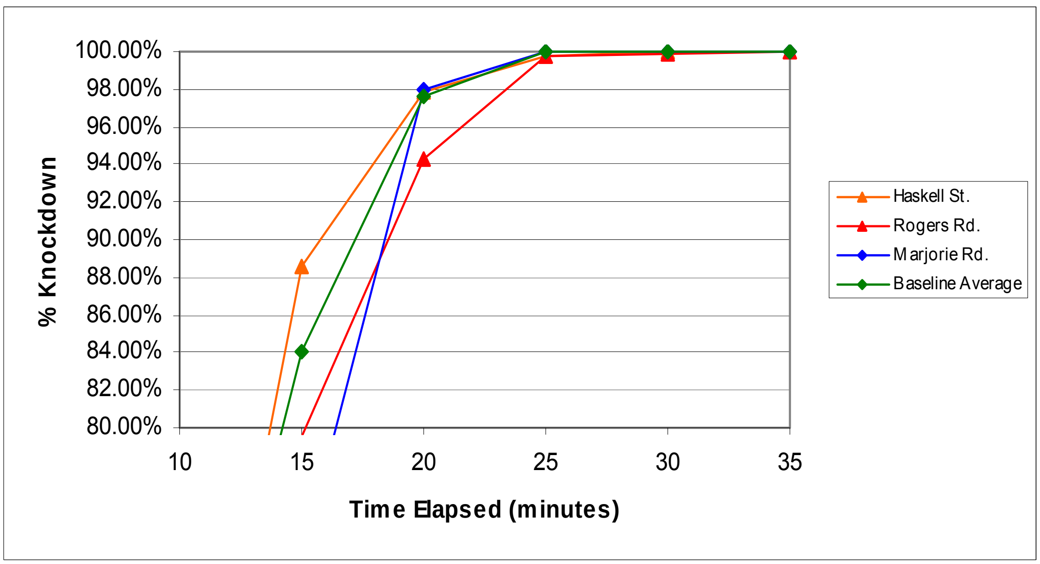


Figure 12: 2012 Time-% Knockdown Curves of Bottle Assays (2) for ANVIL® 10+10 (22.17μg/ml)



The bottle assay results from the 2013 season were slightly off the baseline averages (Figures 13, 14). Overall, 97.78% of the specimens were knocked down by the 30 minute mark, with 93.13% down at the 25 minute mark. The few remaining individual specimens became knocked down shortly after. The acetone only coated bottles had zero knockdown effect (Figure 13).

Figure 13: 2013 Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17µg/ml)

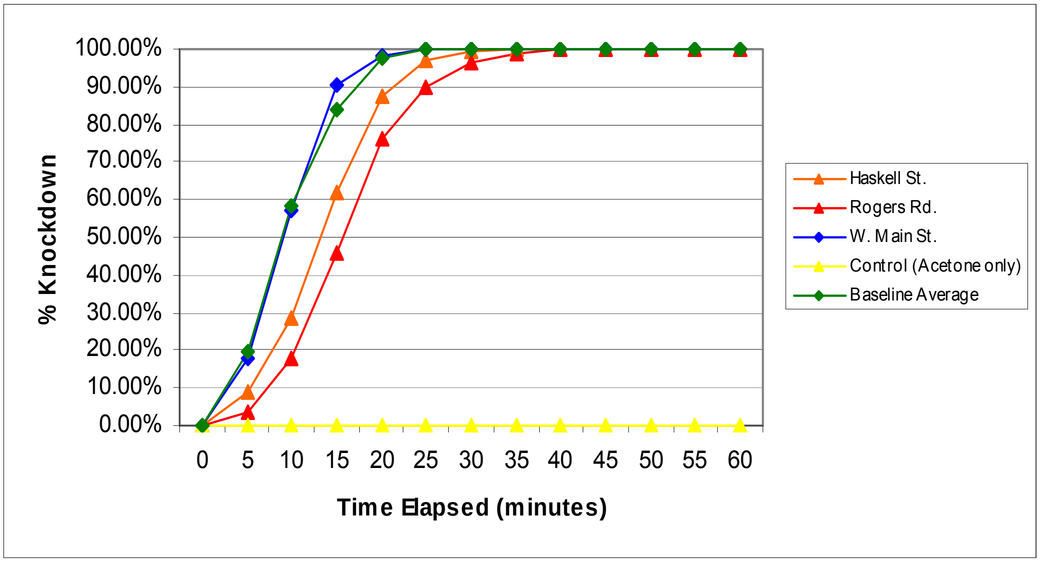
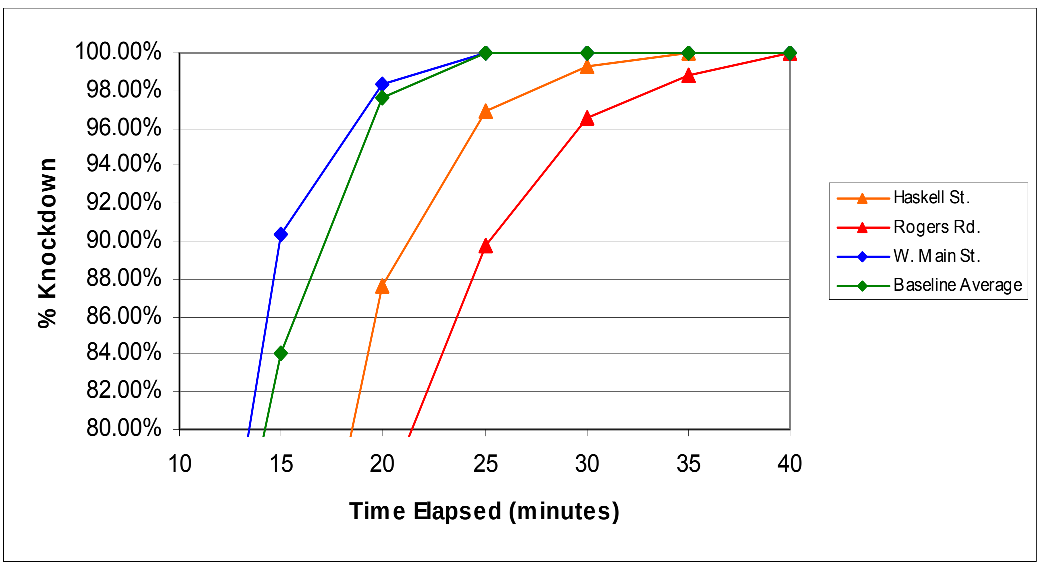


Figure 14: 2013 Time-% Knockdown Curves of Bottle Assays (2) for ANVIL® 10+10 (22.17µg/ml)



The bottle assay results from the 2014 season indicated a slower knockdown curve compared to the original basement average (Figures 15, 16). Despite this reduction, overall there remained a 96.26% knockdown at the 30 minute mark. Few individual mosquito specimens remained after this point for varying amounts of time. The acetone only coated bottles had negligible knockdown effect as the bottle assay control (Figure 15).

Figure 15: 2014 Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17µg/ml)

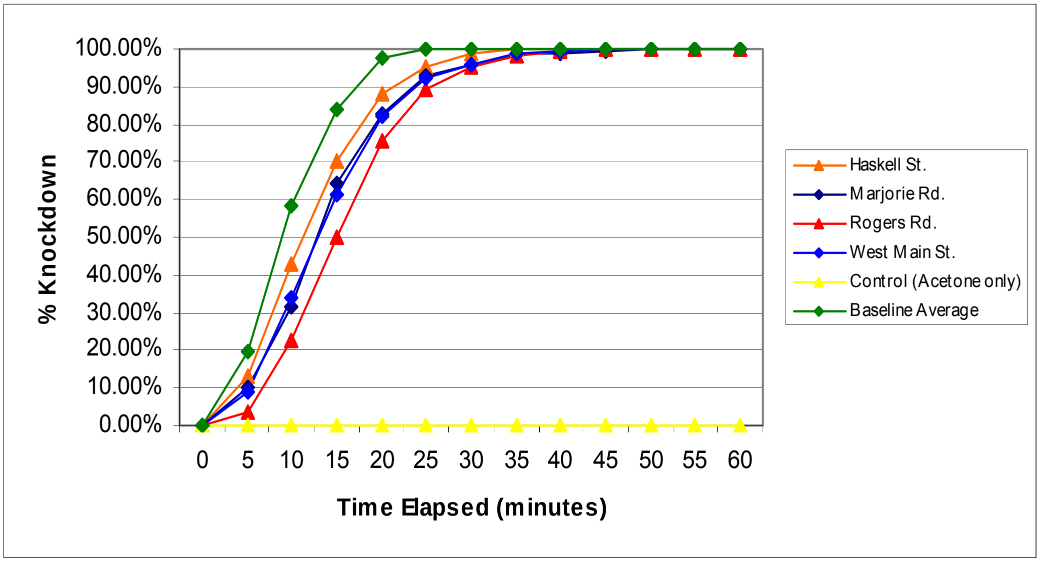
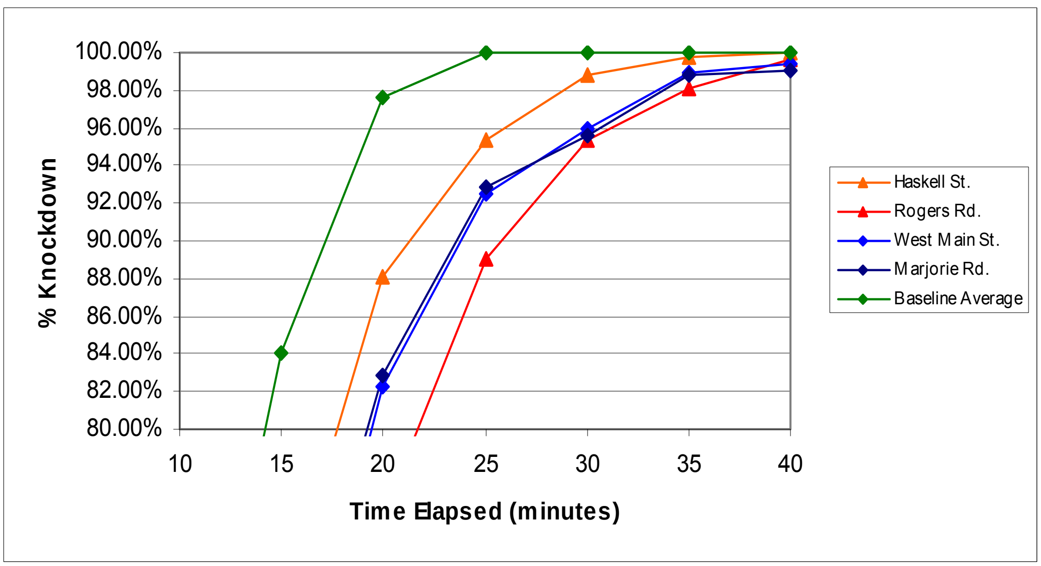


Figure 16: 2014 Time-% Knockdown Curves of Bottle Assays (2) for ANVIL® 10+10 (22.17µg/ml)



The 2015 bottle assay results indicated a slower knockdown curve compared to the original basement average (Figures 17, 18). Despite this reduction, complete knockdown was experienced by the 30 minute mark, with 96.84% down at the 25 minute mark. There was not significant knockdown of specimens within the acetone only control bottles (Figure 17).

Figure 17: 2015 Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17µg/ml)

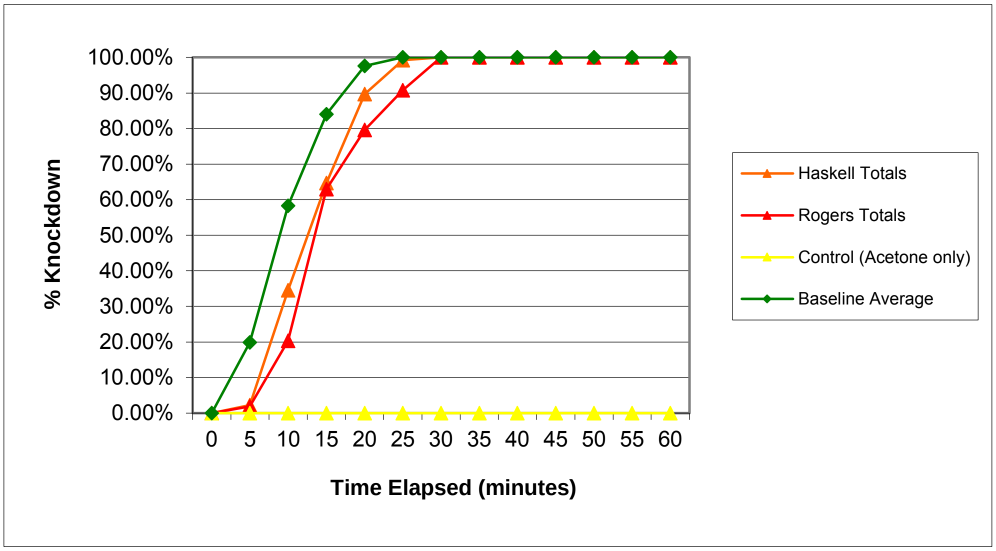
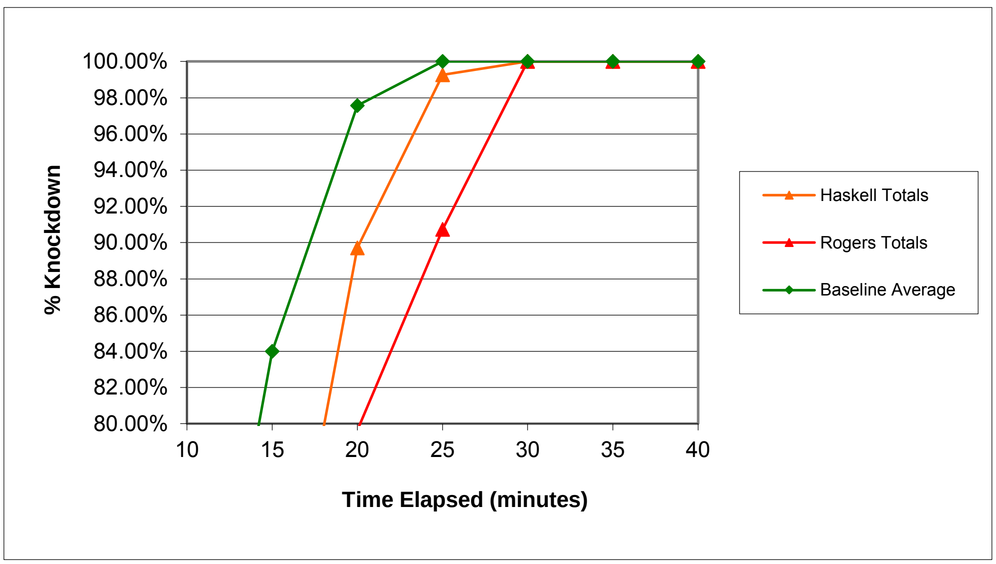
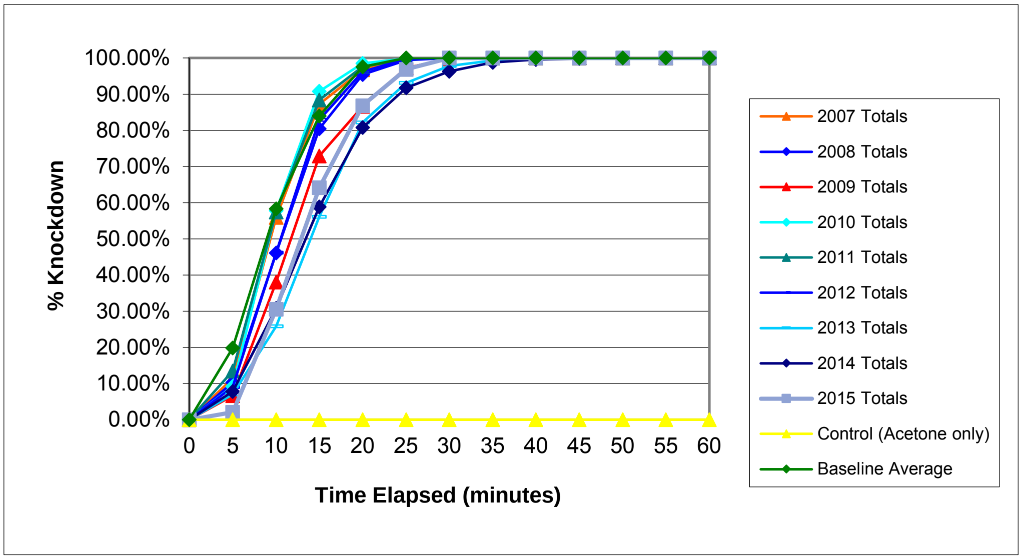


Figure 18: 2015 Time-% Knockdown Curves of Bottle Assays (2) for ANVIL® 10+10 (22.17µg/ml)



Looking at the yearly totals from the nine seasons of bottle assays, one can observe that the knockdown rate has been relatively consistent around the baseline average. Four years, 2009 and the past three seasons had knockdown rates that were slightly lower than the baseline average. The acetone only coated bottles have consistently provided a proper control measure with negligible knockdown observed (Figure 19).

Figure 19: Yearly Comparison of Time-% Knockdown Curves of Bottle Assays for ANVIL® 10+10 (22.17µg/ml)



DISCUSSION

The results of the bottle assays continue to indicate that the level of resistance in the populations of the local mosquitoes tested in the CMMCP service area is not significant enough where a change of pesticide or application protocol is needed at this time. This is not necessarily surprising considering the nature of the CMMCP adulticide program, which is primarily request-only in localized, targeted areas. Another reason would be the vast size of the CMMCP service area, encompassing 41 cities and towns, with non-member municipalities having no mosquito control program scattered in and around them. These factors contribute to local mosquito populations not being consistently exposed to a single class of insecticides, lessening the potential development of resistance. The rapid degradation and low residual nature of the insecticide also could contribute to low resistance development.

CMMCP had used resmethrin (Scourge® Bayer Environmental Science, Montvale, NJ) (EPA Reg. No. 432-667), for their ULV applications since 1988 before switching to ANVIL® 10+10 in 2007. Both products are synthetic pyrethroids. Both insecticides also use piperonyl butoxide (PBO) as a synergist, in different concentrations, with ANVIL® 10+10 using 10% PBO compared to 18% for Scourge® (CDC 2010; Petersen 2004). Before using either of those synthetic pyrethroids, CMMCP had been using Malathion, an organophosphate, which is of a different chemical class (Nauen 2007).

Bottle assays in subsequent seasons will provide additional data for resistance management in the CMMCP service area. In conclusion, the results of the bottle assay research conducted since 2007 show that the level of resistance in the local mosquito populations tested does not warrant a change in protocol or product. The slight decrease in knockdown rate observed the past three seasons is noted, and only reinforces the importance of this program moving forward. As shown this past season, resistance surveillance is a vital tool to ensure control practices remain effective in protecting the public health.

ACKNOWLEDGEMENTS

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Efficacy Trials of the Central Massachusetts Mosquito Control Project Residential Adulticide Program (Update 2015)

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ABSTRACT

To gauge the efficacy of current adulticide practices, the Central Mass. Mosquito Control Project (CMMCP) conducted field trials in the summer of 2015 for both Anvil® 10+10 and Zenivex® E20. Surveillance on the local mosquito populations before and after the residential adulticide applications, indicated the level of control from current treatment procedures can vary based on several dynamics. These forces include but are not limited to, the particular residual properties of the adulticide product used, immigration from mosquitoes beyond the treatment zone, the physical barrier interference, and new local mosquito emergence. An increase in flow rate and/or application area would elevate the level of control of the program. At the particular application rates used during this trial, Anvil® 10+10 and Zenivex® E20 produced comparable levels of control.

BACKGROUND

To help protect the public from mosquitoes and the diseases they may carry, many control projects utilize ultra-low volume (ULV) applications. These machines allow the product to be applied at micron-level droplet size, enabling drift over a target area. CMMCP uses this technology as one component of their integrated mosquito management (IMM) plan (Mount 1998). Since 2007 CMMCP has used Anvil® 10+10 (Clarke Mosquito Control Products, Inc., Roselle, IL) (EPA Reg. No. 1021-1688-8329), a synthetic pyrethroid composed of 10% SUMITHRIN® (Sumitomo Chemical Company, Ltd., Osaka, Japan)(d-phenothrin) and 10% piperonyl butoxide (PBO) (Center for Disease Control and Prevention 2002; Petersen 2004). In 2015 CMMCP also added Zenivex® E20 (Wellmark International, Schaumburg, IL) (EPA Reg. No. 2724-791), with the active ingredient etofenprox, as an adulticide option. In addition to a different active ingredient than Anvil® 10+10, Zenivex® E20 also does not contain any PBO synergist.

During the 2015 season, CMMCP applied Anvil® 10+10 at a flow rate of approximately 1.3oz/min at 10mph, which results in the application of .0012lbs of active ingredient per acre. This is the lowest active ingredient rate available on the product label (CMMCP 2015). Zenivex® E20 was also applied at a flow rate of approximately 1.3oz/min at 10mph. This lower spectrum rate results in approximately .0025lbs of active ingredient per acre (CMMCP 2016). As described in its Standard Operating Procedures Manual, CMMCP conducts a ULV Sprayer Maintenance and Calibration Program to ensure all application equipment is operating correctly. Essentially, spray droplet size and flow rates are monitored and recalibrated if needed. Additional maintenance for the ULV machines such as spray head flushing and ultrasonic cleaning is also conducted through this program.

Although many efficacy trials use caged mosquitoes over free populations because of their quick, standardized results, studies have shown that the reduction of caged mosquitoes is also relative to the reduction of the natural populations (Mount 1998). Despite ULV applications being in common use, several regular issues can be associated with a decreased level of control. These factors can include ineffective insecticide dosage, along with mosquito resistance to that insecticide. Additionally, unfavorable weather conditions, reduced target coverage due to dense vegetation, and quick repopulation of the area can decrease the effectiveness of a ULV application (Curtis 1996; Efird 1991; Mount 1998).

One issue that can directly impact the level of control from a ULV application is mosquito insecticide resistance. Where local mosquito populations are routinely exposed to a single class of insecticide, resistance has been documented, both domestically and internationally. Fortunately, routine resistance surveillance can help indentify the issue so procedural changes can take place to preserve the efficacy of local ULV applications (Brogdon 1998). CMMCP has been conducting resistance surveillance for several years and the results continue to indicate that resistance is not an issue with the local mosquito population (Cornine 2015).

Along with insecticide resistance, weather conditions can also have a significant impact on the level of control from a ULV application. At the time of an application the wind direction and velocity, as well as temperature and temperature gradients can play an important role (Mount 1998). Drift, made possible by the small droplet size, is influenced by the wind direction and velocity. Ideally, wind speeds of 1-7mph are sought with high speeds no greater than 11mph. The temperature present at the time of an application is also important to the efficacy of ULV applications because it will influence mosquito activity in the area.

Temperature gradients in the atmosphere can also impact the delivery of chemical from a ULV machine. Differences in temperature within the air column can help facilitate the inversion of the application product into tree canopies (Mount 1998). This movement of chemical into elevated areas will have a greater impact on species such as *Culiseta melanura* and *Culex pipiens*, which studies have shown favor such heights. These two species are also potential vectors of Eastern Equine Encephalitis (EEE) and West Nile virus (WNV), making them important target species for control projects (Anderson 2004). Considering all these meteorological factors, evenings are typically better suited for applications than early mornings (Mount 1998). This concept plays a role in why CMMCP begins ULV treatments immediately following sunset.

Physical barriers such as structures and vegetation can significantly impact the efficacy of a ULV application (Mount 1998). In such situations, a higher application rate may be needed compensate for the lowered penetration of the droplets. Open spaces, through the lack of obstructions, could likely achieve the same level of control with a lower flow rate. The level of control between open and vegetated area can be as great as four times (Curtis 1996; Mount 1998). Although an IMM plan may favor using the lowest application label rate, in dense vegetation a higher flow rate should be considered or risk ineffective and/or multiple required treatments (Curtis 1996).

The potential for mosquitoes outside the application area to re-infest after treatment is one of the most significant issues when conducting an efficacy trial using field populations (Efird 1991; Mount 1998). The wider the target area, the longer it will take for foreign mosquitoes to repopulate the treatment area. However, relatively small applications could result in limited control and the increased need for additional treatments (Mount 1998). To help determine the efficacy of the CMMCP residential adulticide program, field trials of both Anvil® 10+10 and Zenivex® E20 were conducted during the summer of 2015. Potential procedural changes were determined as well as any significant differences in control level between the two adulticide products.

METHODS

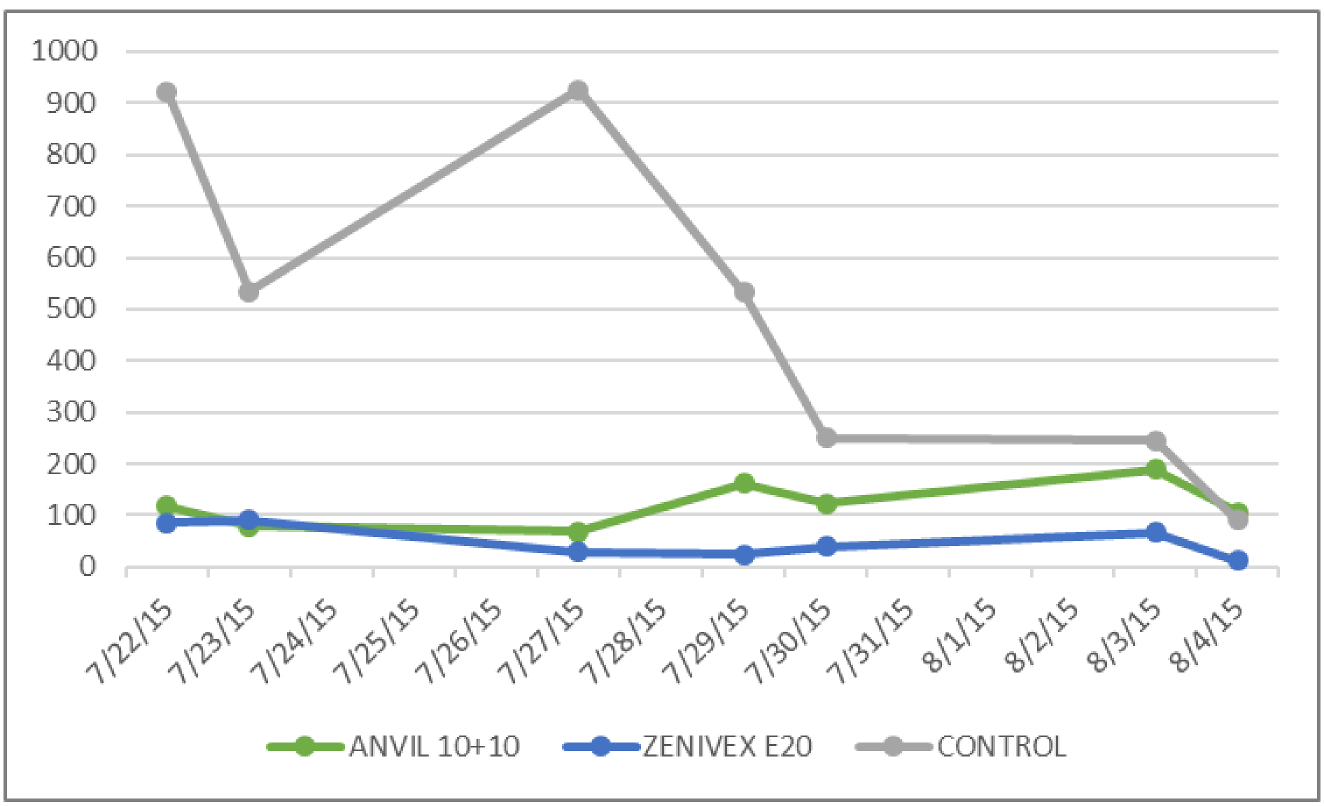
As with past efficacy trials of the CMMCP residential adulticide program, multiple field sites were chosen for the study with several mosquito collections made every week throughout the duration of the project. Two primary sites were selected to be treated during the CMMCP residential adulticide program, with another being left untreated, for use as a control site. One of these treatment sites would be treated with Anvil® 10+10, while the other Zenivex® E20. The sites designated for treatment were selected from areas with elevated numbers of service requests received, while the control site was selected from an area with similar mosquito habitat. To ensure that this control sites was not in the application zone, it was treated as an exclusion location by field technicians.

At the treatment and control sites, mosquito surveillance was conducted using model 512 CDC miniature light traps baited with CO_2 (500ml/min) (John W. Hock Co., Gainesville, FL). Mosquito specimens were identified by species, with the trap location and date of collection noted. Multiple collections were made before and after treatments to help determine the level of control. Once data for both the treatment sites and the control site are plotted, comparisons can be made to help gauge the impact of the adulticide applications on the local mosquito population.

RESULTS

Multiple collections were made at the Anvil® 10+10 and Zenivex® E20 treatment sites as well as the control site prior to the applications. Despite attempts to organize an earlier trial, both treatment sites were scheduled for their coordinated applications on July 28th, 2015. Both treatment sites experienced remarkably similar mosquito collections prior to and following their respective applications. Mosquito species for these two sites were also very close in nature. The control site however, was experiencing significant emergence of *Coquillettidia perturbans* prior to the spray date, which decreased through the remainder of the mosquito season (Figure 1).

Figure 1: Collection Comparison for Treatment Site #1 and Control Site



DISCUSSION

Caged mosquitoes are used in many field trials to help determine the efficacy of a ULV application. This method does have advantages over using field populations, which were used in this study, but lack many inherent issues associated with real world applications. As mosquito activity is heavily influenced by weather conditions present, our field studies accurately reflect daily meteorological changes, whereas the mosquito specimens in cage studies do not. The field studies conducted within the CMMCP residential adulticide program also involve sporadic road networks, varying vegetation amounts, and most importantly the immigration of mosquitoes from outside the treatment zone. This scenario helps determine the level of control experienced by residents following a ULV adulticide by CMMCP.

The results of this field trial indicated that control was achieved on local mosquitoes within the spray zone. The Zenivex® E20 set of mosquito collections experienced slightly greater control than the Anvil® 10+10, although comparable. The overall findings in this study were relatively consistent with the CMMCP efficacy trials of past seasons. Other studies, such as Mount (1998), similarly found that control was achieved initially, but populations rebounded two days after the application. A relatively quick repopulation was proposed as the primary reason for this rebound (Mount 1998).

Both the Anvil® 10+10 and Zenivex® E20 trial sets experienced a minor repopulation of the application area from mosquitoes outside the coverage zone, much like Mount (1998). This is to be expected, considering the focused applications, and the quick breakdown of Anvil® 10+10 and Zenivex® E20 as synthetic pyrethroids (Lesser 1998; CMMCP 2016). Unlike a barrier treatment, which retains its ability to knockdown mosquitoes for potentially weeks, these ULV products do not persist, allowing foreign mosquitoes to migrate into the treated area once settled. Although larger applications zone would likely have offered longer control, irregular road design, as well as various residential and natural obstructions very well could have limited any potential gains. This disadvantage may have been further compensated for by using higher flow rates as well, as the current rates are on the lower end of the allowable spectrums.

The level of control achieved through this program is consistent with expectations. The success of each trial within the study is directly related to the conditions present at the time of application. One slight adjustment to the program that could take place without significant transformation would be an increase in flow rate from the ULV equipment. Considering the nature of these residential adulticide applications, especially localized nature and various obstructions, an increase in flow rate would help combat these associated issues. With meteorological conditions playing such a significant part in the success of a ULV adulticide event, an applicator must take the weather into consideration when deciding the worthiness of any specific treatment, or risk an ineffective, wasteful application.

To ensure member communities receive efficient and effective public health protection, CMMCP will continually monitor the efficacy of the residential adulticide program. Whether the CMMCP will use Anvil® 10+10 or Zenivex® E20 as the primary ULV adulticide product in subsequent seasons will likely depend on costs and projected application rates. Although their levels of control are comparable, Zenivex® E20 does have the advantage of being effective without the use of PBO. CMMCP will continue to look on improving our ability to control mosquitoes and suppress vector-borne disease in central Massachusetts.

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CMMCP AERIAL MOSQUITO LARVAL CONTROL PROGRAM

SPRING 2015

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AERIAL MOSQUITO LARVAL CONTROL PROGRAM – SPRING 2015

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ABSTRACT

The Central Massachusetts Mosquito Control Project conducted a targeted aerial application of Bacillus thuringiensis israelensis to select wetlands in the towns of Billerica, Boxborough, and Chelmsford. This spring aerial application occurred on April 22nd and 23rd 2015, and was utilized to reduce the volume of several early summer mosquito species that emerge in significant numbers. Approximately two thousand acres were treated between the three participating communities. Larval surveillance in these large wetlands following the treatment indicated an overall reduction of 92.62% in these mammal-biting mosquito species from observed pre-treatment levels.

OBJECTIVE

Early season mosquito species such as Ochlerotatus abserratus and Ochlerotatus excrucians develop in temporary pools created by melted snow that floods dormant eggs from the previous season. These univoltine species are some of the first to emerge as adults and cause significant issue to nearby residents due to their pestiferous nature. Because they are univoltine, the eggs that are laid by these adult mosquitoes will lay dormant until snow melt pools are created the following year. Another species, Ochlerotatus canadensis, will also develop in this habitat but may produce more than one generation over the course of a season (multivoltine). More importantly Oc. canadensis has the potential to transmit West Nile virus and Eastern Equine Encephalitis (Andreadis 2005). Controlling these early season mosquito species while they are still in the larval stage is much more advantageous than waiting for them to emerge as adults. As larvae they are relatively contained within their woodland pools, but once able to fly may disperse over a much wider area. At that point control methods would likely require applications of ultra-low volume adulticides. Through this aerial larvicide CMMCP is able to reduce the abundant pestiferous species Oc. abserratus, Oc. excrucians, and Oc. canadensis, which in turn decreases service requests. In the specific case of Oc. canadensis, a vector of West Nile virus and Eastern Equine Encephalitis is reduced as well.

METHODS AND MATERIALS

VectoBac G® (EPA Reg. No. 73049-10) was the Bacillus thuringiensis israelensis (BtI) product chosen for this aerial larvicide application. This formulation is also used in the CMMCP ground larvicide program with great success (CMMCP 2015). This bacterial strain creates a very target-specific compound that, when ingested by the mosquito larvae, causes larval death within 24-48 hours (Extension Toxicology Network 1996; National Pesticide Information Center 2015). VectoBac G® was used at a rate of 5lbs/acre, which is well within the suggested rate of 2.5-10lbs/acre per the product label.

The application was enabled by helicopter services provided by North Fork Helicopter (Cutchogue, New York). On April 22nd the Billerica and Chelmsford portions of the application took place, using the Warren Farm in Chelmsford as the helicopter loading zone area. The anticipated acreage treated for Billerica and Chelmsford was approximately 600 and 520 acres respectively. The following day, April 23rd, the Boxborough application targets were treated through the aerial larvicide program, with Minute Man Airfield (Stow, MA) used as the loading zone. The anticipated acreage treated for Boxborough was approximately 880 acres. Sites treated through this application were chosen with the following considerations: past mosquito larvae activity, vicinity to residential properties, current mosquito larvae levels, and relative inability to be treated through the ground larvicide program. Targets are typically designated as either shrub swamp, shallow marsh or wooded swamp (deciduous, conifer, or mixed) (MassGIS 2015). As per 333CMR 13.04 (7) a legal notification of the aerial larvicide was placed in The Boston Globe on February 4th, 2015, and also posted on the CMMCP website (http://www.cmmcp.org) (Appendix A).

The procedures for larval surveillance used by CMMCP originate from the Generic Environmental Impact Report (GEIR) (Massachusetts Department of Agricultural Resources 1998). The GEIR calls for the establishment of recoverable dip stations (RDS), more specifically one RDS for every 250 acres treated, per town, plus one located in an untreated section of wetlands. At each RDS, both treated and untreated, ten larvae sampling points are flagged and monitored for larvae density before and after the aerial application. With this surveillance the level of control achieved through the aerial larvicide program can be determined. The number of mosquito larvae observed and their instar stage are noted at these flagged positions, with presence of Bti product also determined following the application. Larvae that are sampled at these specific points are placed back into the wetlands right away as to not skew the post-application results. Within the target wetlands, at locations other than the flagged positions, larvae are collected to be identified by species. By knowing the species of larvae involved in the aerial larvicide program, CMMCP can gauge the relative impact of the application on Oc. abserratus, Oc. excrucians, and Oc. canadensis individually.

RESULTS

An overall reduction of 92.62% in mosquito larvae was observed at the RDS following the 2015 spring aerial larvicide of Billerica, Boxborough, and Chelmsford from the pre-application levels. More specifically, the towns of Billerica, Boxborough, and Chelmsford experienced larvae decreases of 87.76%, 100.0%, and 92.45% respectively at their RDS post-application. An overall decrease of 19.93% was also observed at the three untreated (control) RDS from pre-application levels (Table 1; Figures 1-4).

Table 1: Larval Surveillance of Treatment and Control RDS

Treatment Sites	Pre-application	Post-application	Observed Change
BIL116	94	30	-68.08%
BIL112	124	9	-92.74%
BIL408	125	3	-97060%
BOX128	51	0	-100.00%
BOX118	58	0	-100.00%
BOX92	58	0	-100.00%
BOX121	64	0	-100.00%
CHM81	53	0	-100.00%
CHM279	61	2	-96.72%
CHM236	98	14	-85.71%
Overall:	786	58	92.62%
Control Sites	**Pre-application**	**Post-application**	**Observed Change**
BIL227	105	78	-25.71%
ACT37	75	76	1.33%
CHM146	121	87	-28.10%
Overall:	301	241	-19.93%

Figure 1: Billerica Treatment RDS Results Pre- and Post Application

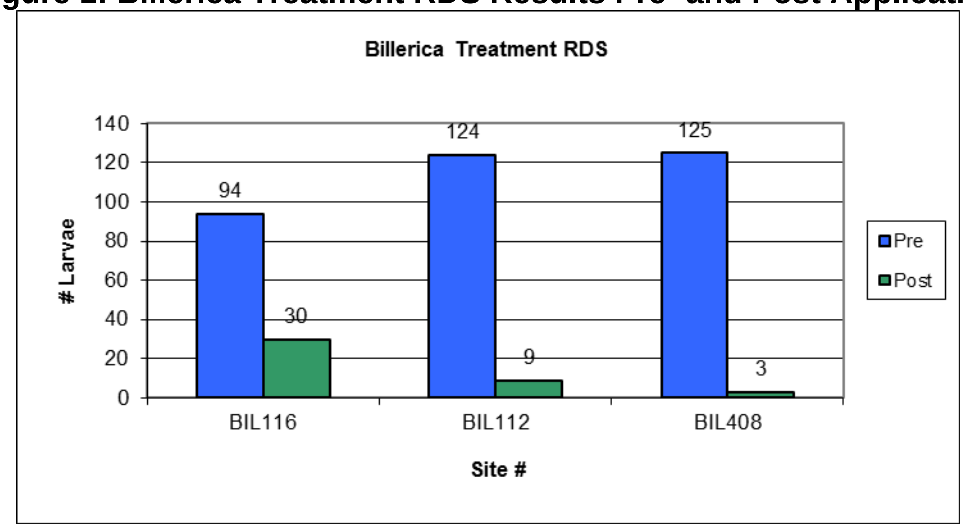


Figure 2: Boxborough Treatment RDS Results Pre- and Post Application

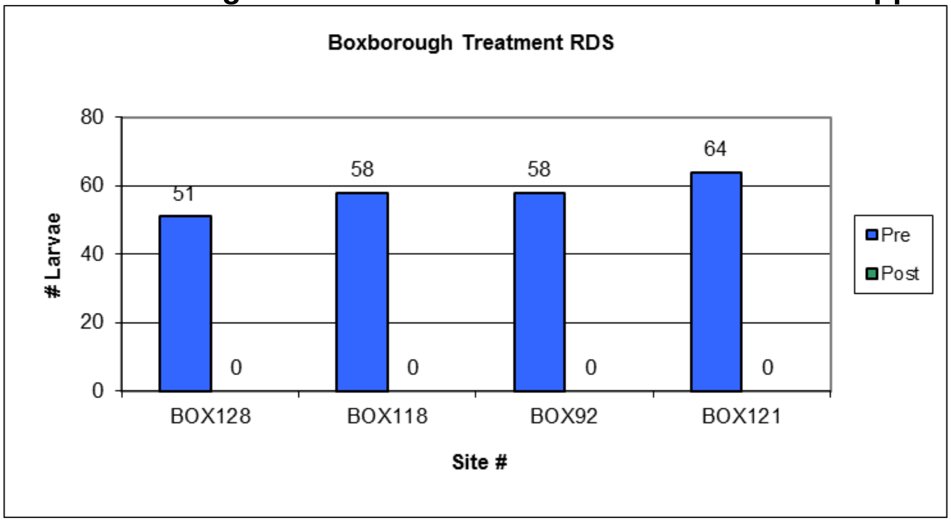


Figure 3: Chelmsford Treatment RDS Results Pre- and Post Application

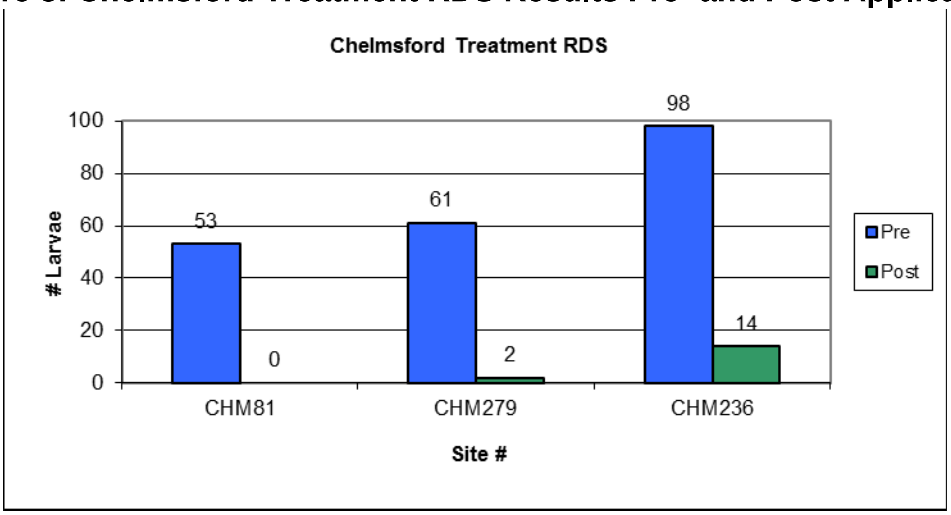
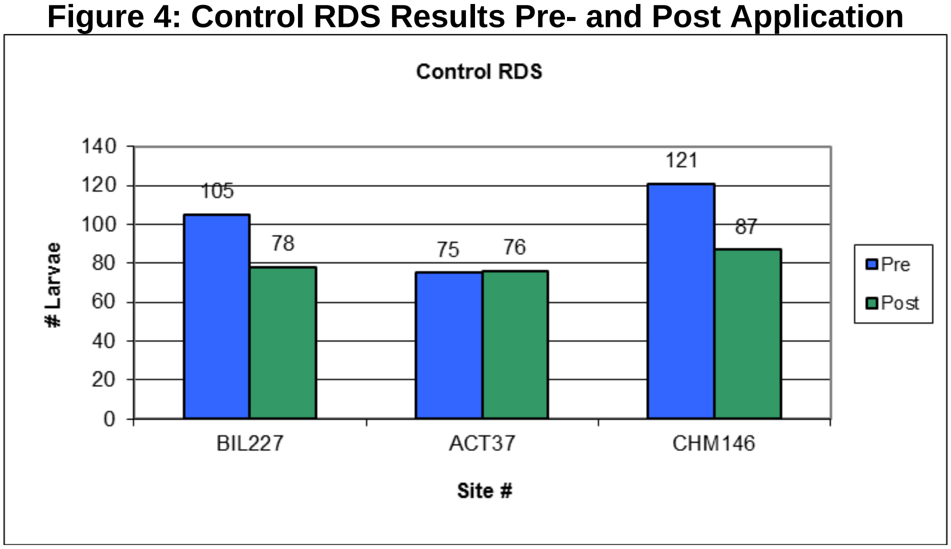


Figure 4: Control RDS Results Pre- and Post Application



DISCUSSION

Once the snow pack melts and temporary woodland pools begin to appear, the CMMCP field technicians begin to monitor for the presence of newly hatched mosquito larvae. This season, surveillance in early April indicated that the level of mosquito larvae and the stage of development would warrant an aerial larvicide application later that month. The application for Billerica and Chelmsford was projected for April 22nd, with Boxborough on April 23rd. Following the aerial larvicide treatments, CMMCP personnel observed an overall decrease in mosquito larvae of 92.62%. The untreated control sites in each of the towns experienced an overall reduction of 19.93%, which was relatively similar to the 2014 aerial application. All of the RDS had complete Bti product coverage at the surveillance flags expect for one. Despite this single varied location, the level of control was still strong within that wetland target.

The 2015 spring aerial larvicide is considered a success for the towns of Billerica, Boxborough and Chelmsford with approximately 92.62% control achieved. The reduction in Oc. abserratus, Oc. excrucians and Oc. canadensis will provide relief for the residents of these municipalities and decrease the need for ULV adulticiding of these species. There is the potential for additional towns in the CMMCP service area to participate in this aerial larvicide program. This possibility will be explored for the 2016 spring aerial larvicide.

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The authors would like to acknowledge the participation of Billerica, Boxborough, and Chelmsford in this supplemental program; North Fork Helicopters for providing the helicopter services; Minute Man Airfield, Stow and Warren Farm, Chelmsford for providing loading zones; the CMMCP Commission, and the CMMCP staff for larval monitoring, larval identification, site selection, map development and assisting with the helicopter application. An additional thanks goes to Nate Boonisar of Norfolk County Mosquito Control District for his assistance with creating target files for the helicopter navigation system.

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FIELD TRIALS OF NATULAR® G30 FOR PRE-HATCH CONTROL OF MOSQUITO LARVAE IN SELECTED SPRING BROOD LOCATIONS

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ABSTRACT

Early each spring season, several particular mosquito species begin to develop in the woodland pools created from melted snow. These species include *Ochlerotatus abserratus*, *Oc. excrucians*, potentially *Oc. canadensis*, and are known mammal biting mosquitoes. Lacking a suitable pre-hatch control option for these species, CMMCP conducted field trials of Natular™ G30. The active ingredient of this product, spinosad, is biologically derived from the fermentation of the soil organism *Saccharopolyspora spinosa*, and released for up to 30 days according to the manufacturer. Results from this field trial were mixed, with a subset of treatment sites experiencing significant control, while the other demonstrating delayed larval development, but eventual pupation.

INTRODUCTION

CMMCP has been without a suitable product for pre-hatch treatments since use of the organochlorine methoxychlor ended several decades ago. Natular™ G30 is an extended release version of the Natular™ G granule. Both utilize spinosad as the active ingredient, which is categorized as one of the only Group 5 insecticides. It is also the first larvicide evaluated by the EPA as a Reduced Risk product. According to the Clarke Mosquito Control Products, Inc., these granules are effective against mosquito larvae in a variety of environments for up to 30 days, depending on habitat conditions (CMMCP 2015). CMMCP sought to test this product as a pre-hatch for spring brood mosquito species such as *Oc. abserratus*, *Oc. excrucians* and possibly *Oc. canadensis*, with the hopes of having a viable option for pre-hatch control available to the program. While *Oc. abserratus* and *Oc. excrucians* are univoltine, having one generation per year, *Oc. canadensis* is generally considered multivoltine, with the potential for more than one generation per season. Additionally, *Oc. canadensis* has shown the ability to harbor West Nile virus and Eastern Equine Encephalitis (Andreadis 2005). Isolated pre-hatch larvicide treatments for these species would lessen the need for larger adulticide events upon adult emergence.

MATERIALS & METHODS

Fifteen total sites were selected from two neighboring towns, and chosen primarily from historical larval surveillance records. Many of these had also been used in previous pre-hatch trials of FourStar® Bti CRG. Twelve of these sites were treated with Natular™ G30 at an application rate of 10lbs/acre. The three other sites were not treated and instead used as control references. The Natular™ G30 applications took place April 1st, 2015, with the majority of sites still frozen over from the winter season.

Observations were taken approximately twice a week at each site. Notes included number of larvae per dip, development stage of larvae, and water temperature. The final larvae checks took place in early May, past the 30 days of estimated effective control from the Natular™ G30 extended release granules.

Results were mixed with the sites in one town showing significant sustained control, while the sites in the adjacent town showing initial control, but eventual pupation, indicating failure. The continuous control subset of sites numbered four, with the delayed but ultimate development subset of treatment sites comprising the other eight. With the variations in success level being associated with town (and applicator), differences in application coverage could have occurred, although with a consistent application rate this may not have occurred. Unidentified differences between the sites of the two towns may have potentially played a role in the disparity of control shown.

CONCLUSION

This field trial of Natular™ G30, involving treated and non-treated control sites, presented mixed results through larval surveillance. One subset of sites maintained control while the other experienced delayed but eventual development. These mosquito larvae ultimately entered the pupal stage, representing a failure. Having significant control in one collection of treatment sites, but not the other, indicates a difference in application or site characteristics. An expanded field evaluation of Natular™ G30 will be conducted in the spring of 2016. This future trial should produce more information on the viability of this product for use as a pre-hatch treatment against local mosquito species.

ACKNOWLEDGEMENTS

The author would like thank the CMMCP Board of Commission, as well as the field technicians that assisted with trial site selection, treatment, and surveillance.

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FIELD TRIALS OF NATULAR® G FOR CONTROL OF *COQUILLETTIDIA PERTURBANS* LARVAE IN SELECTED RETENTION PONDS

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ABSTRACT

One of the primary pestiferous mosquitoes in the CMMCP service area is *Coquillettidia perturbans*, a mammal biting mosquito that develops in cattail habitats. Because *Cq. perturbans* larvae attach the aquatic roots of the cattails, traditional control methods can be less effective. Natular™ G, a relatively novel product, may be an option to address this situation. Spinosad is the active ingredient of Natular™ G, which is created from the fermentation of the naturally occurring soil organism *Saccharopolyspora spinosa*. To evaluate the potential of Natular™ G against *Cq. perturbans*, CMMCP conducted field trials in local retention ponds with a known history of this Eastern Equine Encephalitis and West Nile virus vector species.

INTRODUCTION

By the 1980's the use of products such as methoxychlor (an organochlorine) by CMMCP ceased, leaving no suitable pre-hatch treatments. Natular™ G is a recent addition to the larvicide options available to CMMCP, and uses Spinosad as the active ingredient. This Group 5 larvicide can be used in several different mosquito environments including temporary standing water, freshwater swamps, storm water systems, and artificial containers. Cattail marshes and freshwater emergent vegetation areas are also included in these highlighted application habitats, which makes this product suitable for species such as *Cq. perturbans* that develop in these specific environments. *Cq. perturbans* are unique because as larvae they attach themselves to the root systems of these plants to breathe. CMMCP sought to evaluate Natular™ G for use as a pre-hatch treatment, an option not available since the 1980's.

MATERIALS & METHODS

The retention ponds chosen for this project have been monitored for several seasons. CDC traps baited solely with compressed CO_2 were used over this period to determine the abundance of *Cq. perturbans*. To gauge the viability of Natular™ G on this mosquito species, two of these retention ponds were designated as treatment sites, with two others as non-treated controls. The Natular™ G was applied in accordance with the label at the two treatment locations. Surveillance for *Cq. perturbans* began before emergence began and continued through the season using the same CDC trap configuration that had been used in prior surveillance. Collections from these treatment and non-treatment sites could be compared to one another as well as the past data from those specific retention ponds to determine the level of control achieved from the Natular™ G applications.

The data analysis from this surveillance is not indicative of significant control. This reflection may be influenced by the collection method rather than actual level of control achieved by the Natular™ G on the *Cq. perturbans* population. Although the CDC surveillance traps are positioned in close proximity to the retention ponds, they do not exclude adult *Cq. perturbans* that may have potentially migrated from outside sources, from entering the collection chamber. The applications of Natular™ G may have been timed right, and in adequate amounts to control the *Cq. perturbans* larvae, but if non-native adults entered the surveillance traps, the results would not have reflected the control success.

If the CDC traps collected only native *Cq. perturbans* from the selected retention ponds, the results may be been caused by ineffective Natular™ G, improper treatment schedule, or inadequate application. Although unlikely, the particular batch of product CMMCP utilized in the trials could have been less potent than advertised, which would have contributed to the perceived low level of control. Another potential issue with the product could have been associated with the timing of the application. As Spinosad needs to be ingested for it to be effective, if the *Cq. perturbans* population was at the late 4th instar larval or pupal stage the Natular™ G would not successfully control the mosquitoes.

CONCLUSION

The adult mosquito surveillance conducted around these select retention ponds provided results that do not indicate successful control. It is proposed that the finding is due primary to faults with the surveillance practice of using free standing CDC traps to collect emerging mosquitoes. To address this issue, CMMCP has begun developing stationary emergence traps that will collect adult *Cq. perturbans* directly from the retention pond vegetation mats. This will remove the possibility of non-native mosquitoes skewing the trial collections. These traps will also allow for separate well defined collections within the same retention pond. Potentially, this could create an experimental design where a particular retention pond has designated treated and non-treated areas. Emergence traps could then be established in both section types, reducing the previous bias between different treatment/non-treatment retention ponds. CMMCP will incorporate this surveillance change into future evaluations of Natular™ G and similar products as pre-hatch control options for *Cq. perturbans*.

ACKNOWLEDGMENTS

The authors would like to thank the CMMCP Commission, and past research assistants who helped with this project.

ASIAN TIGER MOSQUITO (ATM) SURVEILLANCE IN CENTRAL MASS. 2016

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INTRODUCTION

The Asian tiger mosquito, *Aedes (Stegomyia) albopictus*, is an introduced and invasive mosquito species in North America. Since its first introduction through the importation of used tires from Asia into Texas in 1985 [9, 16], it has spread across the United States. The Asian tiger mosquito (ATM) is now poised to enter New England within the near future [17]. The ability of this mosquito to use various small water habitats as breeding sites coupled with the expansion of its range through interstate trade and along highways [2, 7, 14] creates a new danger for the transmission of several vector-borne arboviruses to the citizens of Massachusetts. In light of these concerns, Central Massachusetts Mosquito Control Project (CMMCP) has decided to conduct regular ATM surveillance in our district. This presence/absence study will help us determine where introductions of ATM occur and help us prevent this invasive mosquito from gaining a foothold in Central Massachusetts.

<u>Habitat preference and ecology</u>:
The ATM is originally a tree-hole breeding mosquito found along forest edges in tropical and temperate Asia [1, 2, 16]. This mosquito has adapted its tree-hole oviposition reproductive strategy to the kinds of disposable small containers, cups, bottles and cans, tires, planter trays, trash cans and other small water bearing vessels that are found in peridomestic (around human habitation) areas in urban and suburban areas [1, 2, 5, 9]. These small containers tend to create optimal ATM larval habitat, when found in cool, shaded areas with presence of leaf litter [1]. There is also a noted correlation between increased human population and activities and increases in ATM populations [14]. Because of its unique behavior, ATM has been shown to be resistant to control using traditional vector control methods [11, 17].

ATM eggs have demonstrated desiccation resistance and have the ability to overwinter in climates similar to that of southern New England [1, 9, 13, 16]. Under predicted climate change scenarios for the region (i.e., increased average winter temperatures), it may be possible for ATM to be able to overwinter in Massachusetts within the next ten years [7, 11, 17]. Evidence from New Jersey suggests that ATM has a competitive advantage over other common Massachusetts tree-hole breeding mosquito species [1, 2, 16], and has been spreading from its introduction point in primarily urban and industrial habitats into the suburbs surrounding these areas [7].

Host preference:

Unlike the nighttime activities of more “ordinary” mosquito species, ATM has been shown to be an aggressive daytime feeder on mammals [2, 5, 12]. Laboratory evidence shows that when ATM is exposed to a range of mammals, it shows a preference for human scent[1, 2, 16], however, they are aggressive enough to feed on many animals from birds and reptiles to mammals [2, 13, 16]. This broad range of host preference has implicated ATM as a bridge vector, with the ability to transfer zoonotic disease from animal reservoirs to humans [1, 2, 5, 7, 10, 13, 16].

Arbovirus vector competence:

ATM has been determined to be a competent vector for West Nile virus (WNV) in both laboratory settings [14, 18] and in nature [1, 2, 7, 12, 18]. Its aggressive feeding behavior could allow ATM to become a bridge vector between bird virus reservoirs and human hosts [1, 2, 5, 7, 12, 13, 16].

ATM has also been determined to be a competent vector for Eastern Equine encephalitis (EEE) in laboratory settings [13, 14, 19]. It has the ability to become infected by EEE after biting birds [19], has been shown to have a longer survival period with the virus [13] and to have a higher viral transmission rate than similar species [19]. However, the transmission cycle for EEE is more complex and relies upon other species, consequently there is currently no evidence for direct transmission of EEE from ATM to humans [5].

ATM is a competent vector for all four Dengue fever (DENV) serotypes in laboratory settings [2, 14]. While DENV is not currently endemic to Massachusetts, it should be noted that historical records show that DENV outbreaks have occurred in the state [16]. Although there is no evidence for transmission of Chikungunya virus (CHIKV) in the State of Massachusetts, ATM has been shown to be competent vector for CHIKV under laboratory conditions [14]. ATM has also been determined to be the primary vector for recent CHIKV outbreaks in West Africa [6], the Indian Ocean [2, 6], Italy [8] and the Caribbean [11].

ATM has been shown to be vector for canine heartworm (*Dinofilaria immitis*) in Italy [4]. Canine heartworm infections have been rising within the United States for several years, with over one million dogs currently infected [3]. With only ~30% of domestic dogs receiving regular veterinary care [3], canine heartworm could become a major problem for companion animals.

MATERIALS AND METHODS

In the summer of 2015, CMMCP began routine ATM surveillance in our communities by assessing points of likely introduction. These sites include industrial and transport areas, railroad sidings, junkyards and other potential sites. We are currently using two methods of surveillance: the ovitrap and the BG Sentinel™ trap. New methods may be introduced based on evidence from the mosquito research community.

Ovitrap surveillance is conducted by placing small, water-filled cups in several sites in our district. The ovitrap is essentially a 16 oz. plastic cup filled partway with water and all ovitraps are marked with the CMMCP logo [Figure 1]. In this cup, a rough, damp strip of paper is placed to create attractive habitat for ATM and similar species to oviposit their eggs. These damp, mosquito eggcovered papers are returned to our lab where they are raised in our climate-controlled insectary cabinet until to either the 4th larval instar stage or adulthood. These mosquitoes are then identified to species.

The BG Sentinel™ trap [Figure 2] is manufactured by Biogents AG and is designed with the purpose of catching adult, female ATM. It is a bright white and black plastic collapsible cylinder which contains a fan, power source and ATM-specific attractant bait. Adult mosquitoes attracted to this trap are caught in a downdraft fan and collected in a small net bag. These adults are returned to the CMMCP entomology lab for identification.

2015 Surveillance results:
In the 2015 surveillance season, CMMCP collected ~195 ovitrap samples and ~35 BG Sentinel™ sample collections at 16 sites in our district. We are pleased to report that no introductions of ATM have occurred in our communities as of yet. However, the 2015 season did see documented introductions of ATM in other parts of Massachusetts, with at least one instance very near our district. We propose to continue our surveillance in 2016 and choose new sites as new potential habitats are identified.

Figure 1. The water-filled ovitrap, here shown tied to a fence near a transport corridor in Millbury, MA.

Figure 2. The BG Sentinel™ trap, shown with supplemental CO2 canister.

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Inside the Box: Making a Larval Rearing Cabinet for Asian Tiger Mosquito Surveillance

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Introduction

Recent discoveries of introduced populations of Asian tiger mosquito (*Aedes albopictus)* in Massachusetts have created a need for increased ovitrap surveillance in our district. Ovitrap surveillance requires the capture of mosquito eggs on a substrate, then the subsequent egg hatching and larval rearing of young mosquitoes under controlled conditions. Borrowing an idea from the Warren County Mosquito Extermination Commission (Duryea 2014), we set about sketching, designing and building our own in-house insectary for larval rearing. The project was completed in time for the 2015 surveillance season.

The design is simple; a box or closet which contains a fluorescent light which doubles as a heat source and shelving for samples and storage. Doors and vents help maintain constant temperature (Fig. 1).

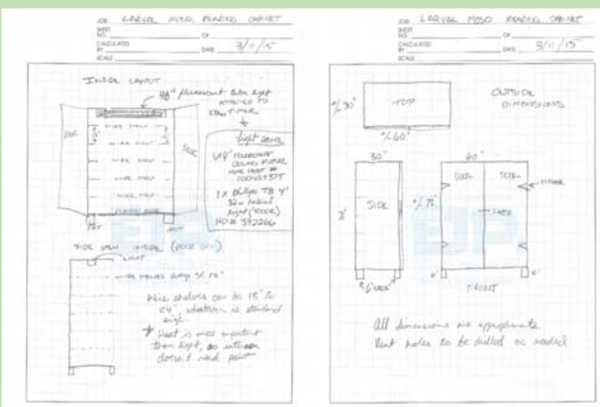

Figure 1. Simple pencil sketch of approximate size and design of larval rearing cabinet

Figure 2. The larval rearing cabinet as built, before fine tuning of photoperiod.

Materials and Use

The cabinet is constructed of simple materials obtained through a local home supply store. Three sheets of ¾ inch birch plywood, one sheet of ½ inch MDF plywood, a few strips of tongue-and-groove paneling, various screws, casters, hinges, a metal shelving unit, a timer and a light fixture. The choice of bulb is important; a 4 foot 32-watt Phillips T8 fluorescent tube putting out ~5000k of natural spectrum light helps maintain temperature. The finished cabinet measures 31” D x 72” H x 60” W, opens like a two-door cupboard and is mounted on casters for easy relocation (Fig. 2). A metal rack system is installed inside to hold larval rearing pans and breeding chambers.

The timer was set to a 12L:12D photoperiod, which was adjusted to 16L:8D in the early spring and late fall to try to maintain a 27-28°C internal temperature (McLean-Cooper *et al*. 2008).

Results and Discussion

The finished cabinet was placed in an unheated garage area, where ambient temperature fluctuated seasonally from ~0 to 30°C (~32 to 90°F). The cabinet was able to maintain consistent internal temperature throughout the breeding season (Fig. 3), with some deviation from the target temperatures during the cooler weather in spring and fall (Fig. 4).

Relative humidity fell far short of the 79-80% necessary to maintain a viable adult population (Fig. 4). Because we were examining larvae and recently hatched adults, we felt that this factor was not important enough to warrant installing a humidifier. To maintain an adult breeding population, a small household humidifier could be easily installed.

Although we did not detect any Asian tiger mosquitoes in our area during the 2015 surveillance season, the larval cabinet provided us with a consistent environment for the raising and identification of mosquito larva and recently hatched adults.

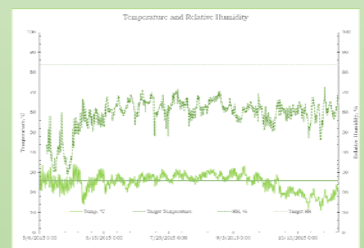

Figure 3. Plot of daily temperature and relative humidity (RH) fluctuations for the 2015 surveillance season. Straight horizontal lines represent target temperature and RH.

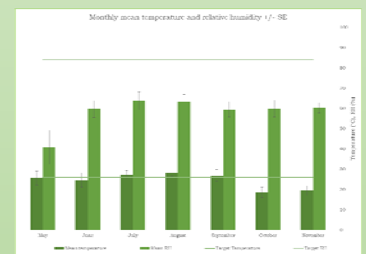

Figure 4. Average monthly temperature and RH for 2015 surveillance season. Error bars represent standard error.

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TOWN OF STOW

DATE	WORK DONE	LOCATION
01-08-15	Administrative Contact	Town Hall
03-03-15	Administrative Contact	Town Hall, Stow Public Library
03-17-15	Administrative Contact	Board of Assessors
	Public Relations	Old Bolton Road, Apple Field Farm Gleasondale Road, Harvard Road, Taylor Road, Crescent Street, Red Acre Road, Treaty Elm Lane, Barton Road, North Shore Drive
03-18-15	Public Relations	Taylor Road, Great Road, Crescent Street, West Acton Road, Gleasondale Road, Treaty Elm Lane, Sudbury Road, Kirkland Drive, No Name Road, Harvard Road, Boxboro Road, Militia Circle, Red Acre Road, Box Mill Road, Homestead Lane, Marlboro Road, Edson Street, Indian Ridge Road, Lakewood Road, Sudbury Road
04-06-15	Stream Cleaning 30’	Taylor Road
	Stream Cleaning 40’	Boxboro Road
	Stream Cleaning 75’	West Acton Road
	Culvert Cleaning (29)	Harvard Road, Lantern Lane, Harvard Road, Delaney Street, Adams Drive, Eliot Drive, Taylor Road, Boxboro Road, West Acton Road, South Acton Road, Tuttle Lane, Red Acre Road, Militia Circle, White Pond Road
04-07-15	Administrative Contact	Town Clerk’s Office
04-14-15	Public Relations	Stow Airport
	Larviciding	Maguire Lane, Elizabeth Drive, Hudson Road
	Larval Survey	Maguire Lane, Elizabeth Drive, Hudson Road, Arbor Glen Road
04-16-15	Larval Survey	Maguire Lane, Hudson Road
04-21-15	Larviciding	Adams Drive, Elliot Drive, Taylor Road
	Larval Survey	Peabody Drive, Adams Drive, Maura Drive, Taylor Road, Garner Road, Asa Whitcomb Way
04-30-15	Public Relations	Timberedge Road
	Larviciding	Timberedge Road, Hudson Road, Athens Road
	Larval Survey	Hudson Road, Cranberry Circle, Hudson Road
05-01-15	Larviciding Recheck	Timberedge Road, Hudson Road
05-04-15	Public Relations	Thicket Circle, Frances Circle
	Larviciding	Thicket Circle, Frances Circle, Walcott Street, Edge Hill Road
	Larval Survey	Frances Circle, Walcott Street, Edge Hill Road, Hudson Road, Billadell Road, Marlboro Road, Railroad Avenue
05-08-15	Public Relations	Packard Road, Circuit Drive, Middlemost Way, Bramble Path,
	Larviciding	Packard Road, Carriage Lane, Boxboro Road, Airport Road, Circuit Drive, Bramble Path, Timberedge Road
	Larval Survey	Boxboro Road, Packard Road, Whelden Lane, Circuit Drive, Middlemost Way, Evelyn Road, Timberedge Road
05-12-15	Larviciding Recheck	Boxboro Road, Circuit Drive
05-13-15	Public Relations	Hudson Road, Timberedge Road, Packard Road, Ministers Way
	Larviciding	Hudson Road, Ministers Way
	Larval Survey	Timberedge Road, Packard Road
05-21-15	Source Reduction Tire Removal [8]	South Acton Road, Boxboro Road
05-26-15	Source Reduction Tire Removal [10]	Boxboro Road
05-27-15	Public Relations	Pine Ridge Road, Sudbury Road, Hudson Road
	Larviciding	Hudson Road – pool
	Larval Survey	Sudbury Road, Pine Ridge Road

TOWN OF STOW

DATE	WORK DONE	LOCATION
05-27-15	Catch Basin Larviciding [155]	Lakewood Road, Wildwood Road, Thicket Circle, Woodland Way, Blueberry Court, Whispering Way, Foxglove Lane, Ladyslipper Lane, Wildlife Way, Fox Court, Cardinal Court, Salamander Lane, Woodpecker Court, North Shore Drive, Sudbury Road, Apple Blossom Lane, Robert Road, Nyra Road, Catherine Circle, Birch Hill Road, Circuit Drive, Sawmill Road, Timberedge Road, Middlemost Way, Pine Ridge Road, Bramble Path, Brookmill Road, Harvard Road, Partridge Lane, Kerrington Way
	Set Up Trap	Bradley Lane
05-28-15	Pick Up Trap	Bradley Lane
05-29-15	Catch Basin Larviciding [164]	Arbor Glen Drive, Heather Lane, Cranberry Circle, Edson Street, Fairway Drive, Seven Star Lane, Randall Road, Sandy Brook Drive, Walcott Street, Edgehill Road, Golden Drive, Frances Circle, Indian Ridge Road, Orchard Drive, McIntosh Drive, Cortland Drive, Minister Way, Johnston Way, Devincent Drive, Bradley Lane, Lane’s End, Faxon Drive, Deerfield Lane, Elm Ridge Road, Meetinghouse Lane, Heritage Lane, Hastings Street, White Pond Road
06-02-15	Set Up Trap	Bradley Lane
06-03-15	Pick Up Trap	Bradley Lane
	Set Up Trap	Samuel Prescott Road
06-04-15	Administrative Contact	Police Department, Board of Health
	Public Relations	Sudbury Road, Robinwood Lane, Barton Road, Pine Point Road, Kingland Road, Foxglove Lane, Ladyslipper Lane, Whispering Way, Salamander Lane, Cardinal Court, Hale Road, Woodpecker Court, North Shore Drive, Davis Road, Gleasondale Road
	Landing Count	Gleasondale Road
	Adulticiding	Sudbury Road, Robinwood Lane, Barton Road, Pine Point Road, Kingland Road, Foxglove Lane, Ladyslipper Lane, Whispering Way, Salamander Lane, Cardinal Court, Hale Road, Woodpecker Court, North Shore Drive, Davis Road, Gleasondale Road, Fox Court, Blueberry Court, Cricket Court, Robinwood Lane
	Pick Up Trap	Samuel Prescott Road
06-09-15	Set Up Trap	Wheeler Road
06-10-15	Pick Up Trap	Wheeler Road
	Set Up Trap	Conant Drive
06-11-15	Administrative Contact	Police Department
	Public Relations	Meeting House Lane, Kerrington Way, Partridge Lane, Wedgewood Road, Lantern Lane, Zander Way, Sylvan Drive, Garner Road, No Name Road, Eliot Drive, Conant Drive, Kirkland Drive, Dunster Drive, Adams Drive, Taylor Road, Asa Whitcomb Way, Packard Road, Randall Road, Seven Star Lane, Walcott Street, Mitchell Road, Frances Circle, Indian Ridge Road, Edge Hill Road, Sandy Brook Drive, Edson Street, Cranberry Circle, Old Bolton Road, Kettell Plain Road, Maple Street, Whitney Road, Hudson Road, Gates Lane
	Landing Count	Kerrington Way
	Adulticiding	Meeting House Lane, Kerrington Way, Partridge Lane, Wedgewood Road, Lantern Lane, Zander Way, Sylvan Drive, Garner Road, Eliot Drive, Conant Drive, Kirkland Drive, Dunster Drive, Adams Drive, Taylor Road, Asa Whitcomb Way, Packard Road, Randall Road, Seven Star Lane, Walcott Street, Mitchell Road, Frances Circle, Mitchell Road, Frances Circle, Indian Ridge Road, Edge Hill Road, Sandy Brook Drive, Edson Street, Cranberry Circle, Old Bolton Road, Kettell Plain Road, Maple Street, Whitney Road, Hudson Road, Gates Lane

TOWN OF STOW

DATE	WORK DONE	LOCATION
06-11-15	Pick Up Trap	Conant Drive
06-16-15	Set Up Trap	Bradley Lane
06-17-15	Pick Up Trap	Bradley Lane
	Set Up Trap	Samuel Prescott Road
06-18-15	Administrative Contact	Police Department
	Public Relations	Great Road, Hiley Break Road, Hudson Road, Hastings Street, Assabet Street, Boxmill Road, Sawmill Road, Pine Ridge Road, Timberedge Road, Middlemost Way, Evelyn Road, Circuit Drive, Whitman Street, Birch Hill Road, Sudbury Road, Boon Road, Robert Road, Deacon Benham Drive, Bradley Lane, Crow Island
	Landing Count	Crow Island
	Adulticiding	Great Road, Hiley Break Road, Hudson Road, Hastings Street, Assabet Street, Boxmill Road, Sawmill Road, Pine Ridge Road, Timberedge Road, Middlemost Way, Evelyn Road, Circuit Drive, Whitman Street, Birch Hill Road, Sudbury Road, Boon Road, Robert Road, Deacon Benham Drive, Bradley Lane, Crow Island
	Pick Up Trap	Samuel Prescott Road
06-23-15	Set Up Trap	Sandy Brook Drive
06-24-15	Pick Up Trap	Sandy Brook Drive
	Set Up Trap	Bradley Lane
06-25-15	Pick Up Trap	Bradley Lane
	Administrative Contact	Police Department
	Public Relations	Wedgewood Road, Kirkland Drive, Eliot Drive, Peabody Drive, Adams Drive, Taylor Road, Packard Road, Point Way, Boxboro Road, Trefry Lane, Brandy Meade Circle, West Acton Road, Canterbury Road, South Acton Road, Farm Road, Red Acre Road, Walnut Ridge Road, Elm Ridge Road, Crescent Street, Gleasondale Road, Lakewood Road, Wildwood Road, Thicket Circle, Queens Lane, Timberedge Road
	Adulticiding	Wedgewood Road, Kirkland Drive, Eliot Drive, Peabody Drive, Adams Drive, Taylor Road, Packard Road, Point Way, Boxboro Road, Trefry Lane, Brandy Meade Circle, West Acton Road, Canterbury Road, South Acton Road, Farm Road, Red Acre Road, Walnut Ridge Road, Elm Ridge Road, Crescent Street, Gleasondale Road, Lakewood Road, Wildwood Road, Thicket Circle, Queens Lane, Timberedge Road
07-01-15	Set Up Trap	Circuit Drive, Samuel Prescott Road
07-02-15	Pick Up Trap	Circuit Drive, Samuel Prescott Road
	Administrative Contact	Police Department
	Public Relations	Barton Road, O’Connell Way, Sudbury Road, Kingland Road, Davis Road, Foxglove Lane, Ladyslipper Lane, Woodland Way, Blueberry Court, Whispering Way, Salamander Lane, Woodpecker Court, Hale Road, North Shore Drive, Crow Island, Sudbury Road
	Adulticiding	Barton Road, O’Connell Way, Sudbury Road, Kingland Road, Davis Road, Foxglove Lane, Ladyslipper Lane, Woodland Way, Blueberry Court, Whispering Way, Salamander Lane, Woodpecker Court, Hale Road, North Shore Drive, Crow Island, Sudbury Road, Wildlife Way, Cricket Court, Cardinal Court, Fox Court
07-08-15	Set Up Trap	Conant Drive, Wheeler Road
07-09-15	Pick Up Trap	Conant Drive, Wheeler Road
	Administrative Contact	Police Department
	Public Relations	Kettle Plain Road, Hudson Road, Maguire Lane, Cranberry Circle, Edson Street, Seven Star Lane, Randall Road, Sandy Brook Drive, Francis Circle, Indian Ridge Road,

TOWN OF STOW

DATE	WORK DONE	LOCATION
07-09-15	Public Relations	Gleasondale Road, Sudbury Road, Lakewood Road, Wildwood Road, Whispering Way, North Shore Drive, Woodpecker Court
	Adulticiding	Kettle Plain Road, Hudson Road, Edson Street, Randall Road, Seven Star Lane, Sandy Brook Drive
07-15-15	Adulticiding	Meetinghouse Lane
	Set Up Trap	Sandy Brook Drive, Bradley Lane
07-16-15	Pick Up Tap	Sandy Brook Drive, Bradley Lane
	Administrative Contact	Police Department
	Public Relations	Zanders Way, Gates Lane, Crow Island, Great Road, Heritage Lane, Elaine Avenue, Hastings Street, Hudson Road, Francis Avenue, Indian Ridge Road, Gleasondale Road, Forrest Road, Sudbury Road, Lakewood Road, Sudbury Road, Wildwood Road, Blueberry Court, Whispering Way, Ladyslipper Lane, Woodpecker Court
	Adulticiding	Zanders Way, Gates Lane, Crow Island, Great Road, Heritage Lane, Elaine Avenue, Hastings Street, Hudson Road, Francis Avenue, Indian Ridge Road, Gleasondale Road, Forrest Road, Sudbury Road, Lakewood Road, Sudbury Road, Wildwood Road, Blueberry Court, Whispering Way, Ladyslipper Lane, Woodpecker Court
07-22-15	Set Up Trap	Samuel Prescott Road, Circuit Drive
07-23-15	Pick Up Trap	Samuel Prescott Road, Circuit Drive
	Administrative Contact	Police Department, Board of Health
	Public Relations	North Shore Drive, Birch Hill Road, Evelyn Road, Pine Ridge Road, Middlemost Way, Sawmill Road, Lawn Lane, Maura Drive, Peabody Drive, Adams Drive, Lowell Drive, Kirkland Drive, Eliot Drive, Garner Road, Wedgewood Road, Kerrington Way
	Adulticiding	North Shore Drive, Birch Hill Road, Evelyn Road, Pine Ridge Road, Middlemost Way, Sawmill Road, Lawn Lane, Maura Drive, Peabody Drive, Adams Drive, Lowell Drive, Kirkland Drive, Eliot Drive, Garner Road, Wedgewood Road, Kerrington Way
	Larviciding	Maura Drive
07-29-15	Set Up Trap	Wheeler Road, Conant Drive
07-30-15	Pick Up Trap	Wheeler Road, Conant Drive
	Administrative Contact	Police Department
	Public Relations	Crow Island, Robinwood Lane, Lakewood Road, Wildwood Road, Queens Lane, Sudbury Road, Kingland Road, Blueberry Court, Ladyslipper Lane, Whispering Way, Woodpecker Court, Hale Road, North Shore Drive, Robert Road, Whitman Street, Pine Ridge Road, Boxboro Road, West Acton Road, South Acton Road, Red Acre Road, Deerfield Lane, Frances Circle, Hudson Road, Sandy Brook Drive, Cranberry Circle, Edson Street, Randall Road, Gleasondale Road, Hillcrest Avenue, Taylor Road, Eliot Drive, Lowell Drive
	Adulticiding	Crow Island, Robinwood Lane, Lakewood Road, Wildwood Road, Queens Lane, Sudbury Road, Kingland Road, Blueberry Court, Ladyslipper Lane, Whispering Way, Woodpecker Court, Hale Road, North Shore Drive, Wildlife Way, Woodland Way, Robert Road, Whitman Street, Pine Ridge Road, Boxboro Road, West Acton Road, South Acton Road, Red Acre Road, Deerfield Lane, Frances Circle, Hudson Road, Sandy Brook Drive, Cranberry Circle, Edson Street, Randall Road, Gleasondale Road, Hillcrest Avenue, Taylor Road, Eliot Drive, Lowell Drive

TOWN OF STOW

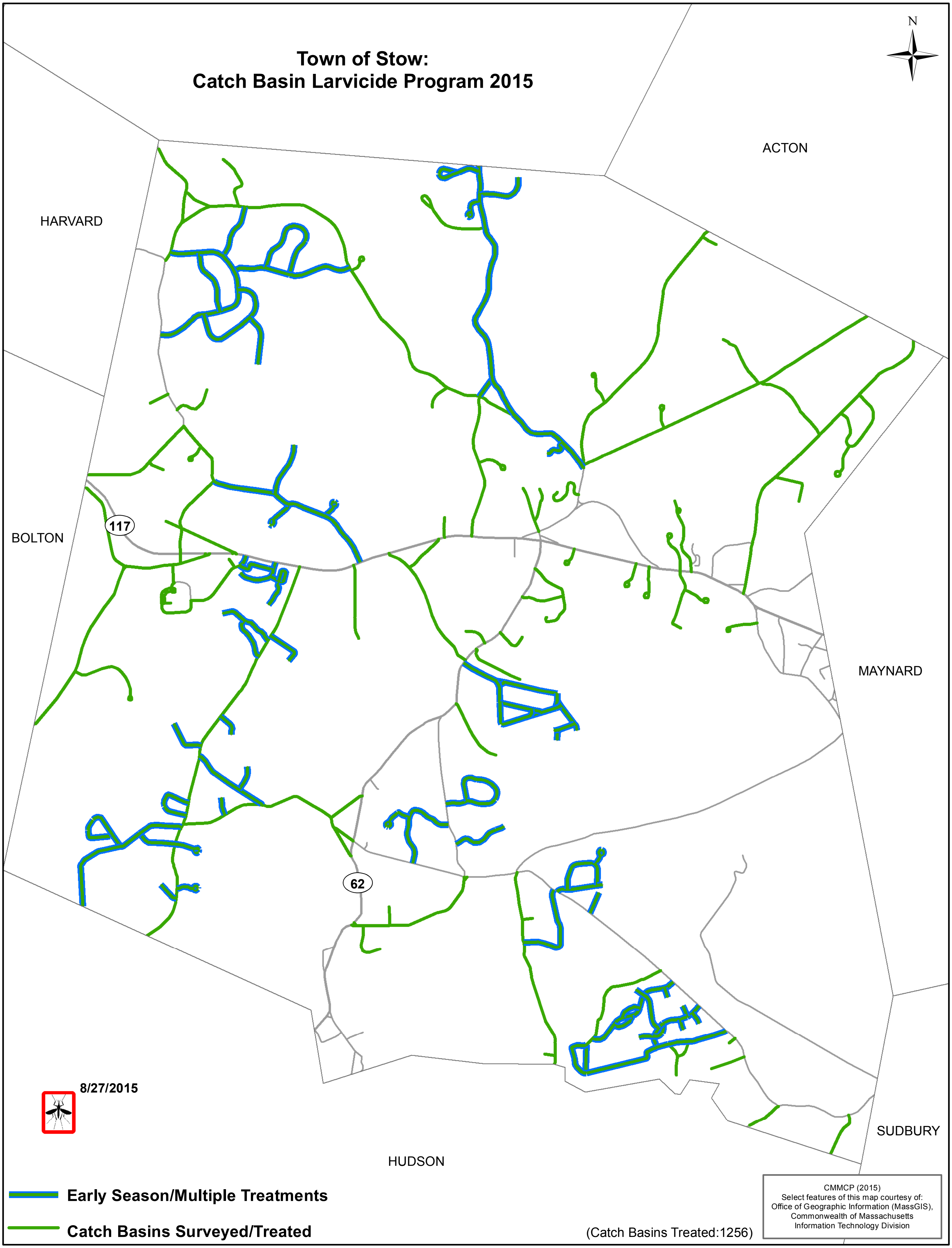
DATE	WORK DONE	LOCATION
07-30-15	Catch Basin Larviciding [286]	Wildlife Way, Cricket Court, Woodland Way, Foxglove Lane, Ladyslipper Lane, Blueberry Court, Woodpecker Court, Fox Court, Cardinal Court, Salamander Lane, North Shore Drive, Davis Road, Queens Lane, Wildwood Road, Lakewood Road, Thicket Circle, Pine Point Road, Barton Road, O’Connell Way, Packard Road, Carriage Lane, Point Way, Boxboro Road, Trefry Lane, Whelden Lane, Hickory Lane, Kirkland Drive, Conant Drive, Eliot Drive, Adams Drive, Peabody Drive, Maura Drive, Lowell Drive, Dunster Drive
08-05-15	Set Up Trap	Bradley Lane, Sandy Brook Drive
08-06-15	Administrative Contact	Police Department, Town Hall
	Public Relations	Hudson Road, Frances Circle, Birch Hill Road, Pine Ridge Road, Crow Island, Red Acre Road, Boxboro Road, Trefry Lane, Adams Drive, Eliot Drive, Whitman Street
	Adulticiding	Hudson Road, Frances Circle, Birch Hill Road, Pine Ridge Road, Crow Island, Red Acre Road, Boxboro Road, Trefry Lane, Adams Drive, Eliot Drive, Whitman Street
	Catch Basin Larviciding [139]	Orchard Drive, Golden Drive, McIntosh Drive, Courtland Drive, Bose Road, Baldwin Drive, Hudson Road, Maguire Lane, Elizabeth Drive, Heather Lane, Arbor Glen Drive, Canterbury Circle, Edson Street, Fairway Drive, Cross Street, Boon Road, Randall Road, Seven Star Lane, Frances Circle, Indian Ridge Road
	Pick Up Trap	Bradley Lane, Sandy Brook Drive
08-12-15	Set Up Trap	Circuit Drive, Samuel Prescott Road
08-13-15	Administrative Contact	Police Department
	Public Relations	North Shore Drive, Kingland Road, Blueberry Court, Sudbury Road, Wildwood Road, Great Road, Hudson Road, Frances Circle, Edgehill Road, Randall Road, O’Connell Way
	Adulticiding	North Shore Drive, Kingland Road, Blueberry Court, Sudbury Road, Wildwood Road, Great Road, Hudson Road, Frances Circle, Edgehill Road, Randall Road, O’Connell Way
	Catch Basin Larviciding [60]	Brandymeade Circle, Canterbury Road, West Acton Road, South Acton Road, Wetherbee Road, Tuttle Lane, Farm Road, Militia Circle, Walnut Ridge Road, Elm Ridge Road, Bradley Lane, Lanes End, Deerfield Lane, Crescent Street
	Pick Up Trap	Circuit Drive, Samuel Prescott Road
08-20-15	Administrative Contact	Police Department
	Public Relations	Hillcrest Avenue, Partridge Lane, Wedgewood Road, Sylvan Drive, Eliot Drive, Adams Drive, Taylor Road, Boxboro Road, Red Acre Road, West Acton Road, Hale Road, Lakewood Road, Wildwood Road, Robinwood Lane, Frances Circle, Hudson Road, Old Bolton Road, Evelyn Road, Timberedge Road, Crow Island
	Adulticiding	Hillcrest Avenue, Partridge Lane, Wedgewood Road, Sylvan Drive, Eliot Drive, Adams Drive, Taylor Road, Boxboro Road, Red Acre Road, West Acton Road, Hale Road, Lakewood Road, Wildwood Road, Robinwood Lane, Frances Circle, Hudson Road, Old Bolton Road, Evelyn Road, Timberedge Road, Crow Island
	Larviciding	Hudson Road – swimming pool
	Set Up Trap	Conant Drive
08-21-15	Pick Up Trap	Conant Drive
08-26-15	Set Up Trap	Sandy Brook Drive, Bradley Lane
08-27-15	Administrative Contact	Police Department, Board of Health
	Public Relations	Eliot Drive, Adams Drive, Packard Road, Boxboro Road, West Acton Road, Red Acre Road, Sudbury Road, Hale Road,

TOWN OF STOW

DATE	WORK DONE	LOCATION
		North Shore Drive, Woodpecker Court, Blueberry Court, Edson Street, Hudson Road, Frances Circle
	Adulticiding	Eliot Drive, Adams Drive, Packard Road, Boxboro Road, West Acton Road, Red Acre Road, Sudbury Road, Hale Road, North Shore Drive, Woodpecker Court, Blueberry Court, Edson Street, Hudson Road, Frances Circle
	Catch Basin Larviciding [78]	Old Bolton Road, Maple Street, Kettle Plain Road, Hiley Brook Road, Lantern Lane, Cider Mill Road, Sylvan Drive, October Lane, Fieldstone Drive, Gates Lane, Wheeler Road, Whitney Road, Hillcrest Avenue
	Pick Up Trap	Sandy Brook Drive, Bradley
09-01-15	Source Reduction Tire Removal [7]	Great Road
09-02-15	Set Up Trap	Samuel Prescott Road, Circuit Drive
09-03-15	Pick Up Trap	Samuel Prescott Road, Circuit Drive
09-10-15	Set Up Trap	Wheeler Road, Conant Drive
09-11-15	Pick Up Trap	Wheeler Road, Conant Drive
09-16-15	Set Up Trap	Bradley Lane, Sandy Brook Drive
09-17-15	Pick Up Trap	Bradley Lane, Sandy Brook Drive
09-22-15	Catch Basin Larviciding [224]	Apple Blossom Lane, Robert Road, Catherine Circle, Birch Hill Road, Nyra Road, Treaty Elm Road, Athens Road, Sandy Brook Drive, Walcott Street, Mitchell Road, Edgehill Road, Billadell Road, Circuit Drive, Middlemost Way, Timberedge Road, Sawmill Road, Evelyn Road, Homestead Lane, Brook Mill Road, Ministers Way, Johnston Way, Devincent Drive, Heritage Lane, Kirkland Drive, Conant Drive, Lowell Drive, Dunster Drive, Eliot Drive, Adams Drive, Peabody Drive
09-23-15	Catch Basin Larviciding [150]	Dawes Road, Hallocks Point Road, State Road, Bruen Road, Hale Road, Barton Road, O'Connell Way, Martin Lane, Forest Road, Sudbury Road, Warren Road, Hartley Road, Russet Lane, Harvard Road, Kerrington Way, Partridge Lane, Wedgewood Road, Delaney Street, Zander Way, Garner Road, No Name Road, Maura Drive, Asa Whitcomb Way, Packard Road, Boxboro Road, Whelden Lane, Trefry Lane, Hickory Lane, Point Way, Lakewood Road, Wildwood Road, Thicket Circle, Queens Lane, Kingland Road, Davis Road, North Shore Drive, Wildlife Way, Cricket Court, Woodpecker Court, Fox Court, Cardinal Court, Woodland Way
	Set Up Trap	Circuit Drive, Samuel Prescott Road
09-24-15	Pick Up Trap	Circuit Drive, Samuel Prescott Road
09-25-15	Larviciding	Maguire Lane, Elizabeth Drive, Great Road, Crescent Street, Hudson Road, Taylor Road
09-30-15	Set Up Trap	Conant Drive, Wheeler Road
10-01-15	Pick Up Trap	Conant Drive, Wheeler Road
10-07-15	Set Up Trap	Sandy Brook Drive, Bradley Lane
10-08-15	Pick Up Trap	Sandy Brook Drive, Bradley Lane
10-29-15	Administrative Contact	Town Hall
12-14-15	Trap Site Survey	Railroad Avenue, Church Street, Woodland Way, Queens Lane, Lakewood Road, Wildwood Road, Barton Road, Cricket Court, Davis Road, North Shore Drive, Robinwood Lane, Forest Road, Fairway Drive, Seven Star Lane, Walcott Street
12-16-15	Trap Site Survey	Hudson Road, Mitchell Road, Indian Ridge Road, Heather Lane, Maguire Lane, Lantern Lane, Old Bolton Road, Kettle Plain Road, Delaney Street, Zander Way, October Lane, Harvard Road, Garner Road, Maura Drive, Taylor Road
12-17-15	Stream Cleaning 340'	Walcott at Hudson Street, Athens Road, Kettle Plain Road

TOWN OF STOW

DATE	WORK DONE	LOCATION
	Culvert Cleaning (5)	Walcott at Hudson Street, Athens Road, Kettle Plain Road
12-18-15	Stream Cleaning 240’	Boxboro Road, Taylor Road, Middlemost Way
	Culvert Cleaning (9)	Boxboro Road, Taylor Road, South Acton Road, Middlemost Way
12-22-15	Stream Cleaning 785’	Sudbury Road, Woodland Way at Ladyslipper Lane, Whitney Road, Hudson Road
	Culvert Cleaning (11)	Sudbury Road, Woodland Way, Woodland at Ladyslipper Lane, Whitney Road, Hudson Road



Town of Stow:
Catch Basin Larvicide Program 2015
N
ACTON
HARVARD
BOLTON
117
MAYNARD
62
SUDBURY
HUDSON
8/27/2015
Early Season/Multiple Treatments
Catch Basins Surveyed/Treated
(Catch Basins Treated:1256)
CMMCP (2015)
Select features of this map courtesy of:
Office of Geographic Information (MassGIS),
Commonwealth of Massachusetts
Information Technology Division

2015 SUMMARY

The Central Massachusetts Mosquito Control Project (the Project) currently provides its services to 41 cities and towns throughout Middlesex and Worcester Counties. The Project's headquarters is located at 111 Otis Street, Northboro, MA. Tours of the headquarters or visits to field work sites may be arranged by calling the office in advance. Please call (508) 393-3055 during business hours for more information. The Project practices Integrated Pest Management (IPM), blending state of the art methods and techniques with expertise, experience, and scientific research to provide our member communities with environmentally sound and cost effective mosquito control.

During 2015 the Project received sixteen thousand, three hundred and eighty-nine (16,389) requests for service from town residents and officials. Ten thousand (10,000) pounds of Bti (*Bacillus thuringiensis israelensis*) was applied by helicopter over two thousand (2,000) acres in 3 towns, Chelmsford, Billerica & Boxborough, and three thousand, one hundred and twelve (3,112) pounds by hand over six hundred and twenty-two (622) acres throughout our service area were applied to area wetlands to reduce the emergence of adult mosquitoes. This represents over two thousand, six hundred and twenty-two (2,622) acres of wetland that was treated with this mosquito-specific bacterium, significantly reducing adult mosquito populations in these areas. Bti mosquito larvicide is used to treat areas where mosquito larvae are found. We routinely check known larval habitats kept in our database, but also encourage the public to notify us of any areas they suspect could breed mosquitoes. Our field crews will investigate all such requests and treat the area only if surveillance gathered at the time shows an imminent threat of mosquito emergence. Eighty four thousand, nine hundred and two (84,902) catch basins were treated with larvicidal product to control the mosquitoes that seek out these cool dark wet areas to develop, including the *Culex* mosquito, a major target for West Nile Virus transmission. One thousand, one hundred and ten (1,110) culverts were cleaned in an attempt to eliminate unnecessary standing water and reduce mosquito breeding. This work was done in conjunction with cleaning, clearing, and digging of one hundred and forty-two thousand, six hundred and three (142,603) feet of streams, brooks and ditches. This represents over twenty-seven (27) miles of waterways which were cleaned and improved by Project personnel in 2015.

The Mosquito Awareness Program which we offer to elementary schools and other civic organizations in our district has become very popular. Project staff meets with students, teachers or concerned residents to discuss mosquito biology, mosquito habitat, and control procedures. Much of the presentation is directed towards what children and their families can do to prevent mosquitoes from breeding around their homes. Slides, videos, coloring books and other handouts make this an interesting program. This program is tailored to meet the needs of the specific audience. In 2015, CMMCP laboratory personnel and other administrative staff made fifty-five (55) educational presentations before two thousand two hundred and ten (2,210) students in thirteen (13) Elementary schools. CMMCP gave a presentation on our program to 8 Clarke University students in the Clarke Vector Ecology program and exhibited at nine (9) public meetings such as health fairs, Earth Day celebrations and other public events. The administrative staff also presented to five (5) member community town boards at their request, three (3) member community cable access channels, seven (7) annual or special town meetings, and 1 requests from non-member town for information on our program. 2011 marked the start of the “CMMCP Mosquito Education Program for Seniors” in which presentations are conducted at local senior centers to increase mosquito-borne disease awareness. Three (3) presentations to fifty (50) senior citizens were conducted in 2015 and this program continues to grow. Over 1,000 specialized brochures for this program were distributed through this program, funded by a grant received from the Northeastern Mosquito Control Association.

Our goal is to manage all mosquito problems with education, wetlands restoration or larviciding, but we recognize that there are times when adult mosquito spraying is the only viable solution. In such cases specific areas are treated with either hand-held or pickup truck mounted sprayers if surveillance gathered at the time exceeds a pre-determined threshold to warrant an application. This program is offered on a **request-only** basis, and the exclusion process allows residents and/or town officials to exclude areas under their control from this or any part of our program.

The Project's surveillance program monitors adult mosquito and larval population density, and is the backbone for prescribing various control techniques. Specialized mosquito traps are deployed throughout the Project’s service area to sample for mosquitoes that may be transmitting mosquito-borne diseases. In conjunction with the Mass. Dept. of Public Health we sample in areas suspected of harboring WNV and other viruses. One thousand three hundred and nineteen (1,319) pools (collections) of mosquitoes totaling thirty two thousand, one hundred and twenty-two (32,122) specimens were tested for mosquito-borne viruses this year. Eleven (11) collections were identified positive this year; ten (10) with West

Nile Virus (WNV) and one (1) with Eastern Equine Encephalitis (EEE)– details are available in the Medical Entomology report in this document. CMMCP lab personnel processed four thousand, two hundred and forty-four (4,244) collections of mosquitoes containing seventy six thousand and sixty (76,060) individual specimens, representing twenty-seven (27) mosquito species.

Some additional highlights from 2015:

- Resistance management study; no significant resistance to pyrethroids noted, no change recommended in adulticide material choice (see full report).

- Resident satisfaction survey: conclusion; overall satisfaction with the adulticide program was 95.1%, 99.5% plan to use our services again (see full report).

- CMMCP participates in the EPA's WasteWise program, tracking our source reduction (tire recycling) efforts. Our efforts in this program were recognized by the EPA – Region 1 in 2014 with an "Environmental Merit Award" for pesticide reduction.

Educational pamphlets are available to anyone interested in learning about mosquito control and the services provided by the Project, and these items are routinely stocked in member Town/City Halls and libraries. Display boards with information on our program are rotated through area Town Halls throughout the year. We also have a website, **www.cmmcp.org** that has extensive information on mosquito biology, our control procedures, etc. This website has become a model for other Mosquito Projects and has been widely used throughout our service area and beyond.

For Earth Day 2010, CMMCP officially announced a tire recycling program added as a value added service to our member cities and towns. This program operates under grant monies received and the CMMCP operating budget. Tire piles provide suitable areas for larval mosquito development, including those species known to carry West Nile virus. During the course of one season, the potential exists for hundreds or even thousands of mosquitoes to emerge from just one tire. In 2015 we collected a total of two thousand, eight hundred and twenty-one (2,821) tires in twenty-three (23) member cities and towns – details are available in the Source Reduction/Tire Recycling report in this document. Collections will continue as time and resources allow.

We recently stated a pilot program for beaver mitigation in member communities. More information can be found by calling our office at (508) 393-3055 or on our website at www.cmmcp.org/beaver_program.htm.

We would like to thank you for your support during 2014 and we look forward to helping you and your community with its mosquito problems in 2015 and beyond.

Respectfully submitted,

Timothy D. Deschamps, Executive Director

COMMONWEALTH OF MASSACHUSETTS
STATE RECLAMATION & MOSQUITO CONTROL BOARD

CENTRAL MASSACHUSETTS MOSQUITO CONTROL PROJECT

est. 1973

EXECUTIVE SUMMARY
2015

February 2016

CMMCP MISSION STATEMENT

The objective of the Central Massachusetts Mosquito Control Project (CMMCP) is to attain an efficient, economic mosquito control operation which will provide the best results possible and be consistent with all ecological aspects and the best interests of the member towns.

Our goal is to reduce mosquito exposure to the public, and the potential for disease transmission by mosquitoes, by utilizing proven, sound mosquito control techniques. CMMCP believes the best way to accomplish this task is by practicing an Integrated Pest Management (IPM) approach as it relates to mosquito control in Massachusetts. IPM utilizes a variety of control techniques and evaluation procedures. Control efforts are undertaken only after surveillance data has been collected and analyzed. Training, experience and common sense dictate our response in any given situation.

It is our desire and responsibility for this Project to have the best mosquito control for the communities that we serve.

INTRODUCTION:

The Central Massachusetts Mosquito Control Project currently provides its services to 41 cities and towns throughout Middlesex and Worcester Counties. The Project's headquarters is located at 111 Otis Street, Northboro, MA. Please call (508) 393-3055 during business hours for information. Twenty (20) full time and three (3) summer interns were employed at CMMCP in 2015. This the year we received a total of sixteen thousand, three hundred and eighty-nine (16,389) requests for service from residents and officials. A map of our service area is on page 7.

EDUCATION:

The Mosquito Awareness Program which we offer to elementary schools and other civic organizations in our district has become very popular. Project staff meets with students, teachers or residents to discuss mosquito biology, mosquito habitat, and control procedures. Much of the presentation is directed towards what can be done to prevent mosquitoes from breeding around their homes. This program is tailored to meet the needs of the specific audience. In 2015, CMMCP laboratory personnel and other administrative staff made fifty-five (55) educational presentations before two thousand two hundred and ten (2,210) students in thirteen (13) Elementary schools. CMMCP gave a presentation on our program to 8 Clarke University students in the Clarke Vector Ecology program and exhibited at nine (9) public meetings such as health fairs, Earth Day celebrations and other public events. The administrative staff also presented to five (5) member community town boards at their request, three (3) member community cable access channels, seven (7) annual or special town meetings, and 1 requests from non-member town for information on our program. 2011 marked the start of the “CMMCP Mosquito Education Program for Seniors” in which presentations are conducted at local senior centers to increase mosquito-borne disease awareness. Three (3) presentations to fifty (50) senior citizens were conducted in 2015 and this program continues to grow. Over 1,000 specialized brochures for this program were distributed through this program, funded by a grant received from the Northeastern Mosquito Control Association. Several different educational pamphlets are available to anyone interested in learning about mosquito control and the services provided by the Project, and these items are routinely stocked in member Town/City Halls and libraries. Display boards with information on our program are rotated in area Town/City Halls throughout the year. Bookmarks with educational information have been printed and stocked in member libraries and town halls, and are used as part of the education program. We also have a website at www.cmmcp.org that has extensive information on mosquito biology, our control procedures, products we use, etc.

DITCH MAINTENANCE & WETLAND RESTORATION:

As part of our effort to reduce the need for pesticides we continue to place great emphasis our wetlands restoration program. By cleaning clogged, degraded and overgrown waterways, mosquito breeding from that area can be reduced or eliminated and drainage areas are restored to historic conditions. One thousand, one hundred and ten (1,110) culverts were cleaned in an attempt to eliminate unnecessary standing water and reduce larval mosquito habitat. This work was done in conjunction with cleaning, clearing, and digging of one hundred and forty-two thousand, six hundred and three (142,603) feet of streams, brooks and ditches. This represents over twenty-seven (27) miles of waterways which were cleaned and improved by Project personnel in 2015.

ARBOVIRUS CONTROL:

As part of our West Nile Virus (WNV) prevention program, eighty four thousand, nine hundred and two (84,902) catch basins were treated with larvicidal products to control the mosquitoes that seek out these cool dark wet areas to develop, including the *Culex* species of mosquito, a major target for West Nile Virus transmission. We identify priority areas in each town and treat the basins in these selected areas to reduce the emergence of this arbovirus. The priority areas are as follows: Prior year WNV activity; senior centers & over 55 housing developments; recreation areas; schools and neighborhoods (higher density first); industrial areas. We performed pre-emptive treatments in late May in areas that showed West Nile Virus in the prior year, with follow up treatments later in the season as part of our standard protocol treatment.

MOSQUITO SURVEILLANCE:

The Project's surveillance program monitors adult mosquito and larval population density, and is the backbone for prescribing various control techniques. Specialized mosquito traps are deployed throughout the Project's service area to sample for mosquitoes that may be transmitting mosquito-borne diseases. In conjunction with the Mass. Dept. of Public Health we sample in areas suspected of harboring WNV and other viruses. One thousand three hundred and nineteen (1,319) pools (collections) of mosquitoes totaling thirty two thousand, one hundred and twenty-two (32,122) specimens were tested for mosquito-borne viruses this year. Eleven (11) collections were identified positive this year; ten (10) with West Nile Virus (WNV) and one (1) with Eastern Equine Encephalitis (EEE). CMMCP lab personnel processed one thousand four hundred and fifty (1,450) collections of mosquitoes containing four thousand, two hundred and forty-four (4,244) collections of mosquitoes containing seventy six thousand and sixty (76,060) individual specimens, representing twenty-seven (27) mosquito species.

Target Species	***Ae. vexans***	***Cq. perturbans***	***Cs. melanura***	***Oc. canadensis***	***Culex spp.***	**All Species**
No. Pools	298	615	187	232	1027	4244
Total Specimens	2527	35543	1237	4823	18055	76060
No. Pools WNV +	0	0	1†	0	9†	10†
No. Pools EEE +	0	0	0	0	1†	1†

†Pool of WNV+ *Culex pipiens/restuans* complex collected in Clinton on 8/27/15
†Pool of WNV+ *Culex pipiens/restuans* complex collected in Lowell on 9/4/15
†Pool of WNV+ *Culex pipiens/restuans* complex collected in Millbury on 9/9/15
†Pool of WNV+ *Culex pipiens/restuans* complex collected in Millville on 9/10/15
†Pool of WNV+ *Culex pipiens/restuans* complex collected in Millbury on 9/17/15
†Pool of WNV+ *Culex pipiens/restuans* complex collected in Natick on 9/17/15
†Pool of WNV+ *Culex pipiens/restuans* complex collected in Sherborn on 9/17/15
†Pool of WNV+ *Culex pipiens/restuans* complex collected in Northbridge on 9/18/15
†Pool of WNV+ *Culex pipiens/restuans* complex collected in Wilmington on 9/22/15
†Pool of EEE+ *Culex pipiens/restuans* complex collected in Northbridge on 9/25/15
†Pool of WNV+ *Culiseta melanura* collected in Westborough on 9/30/15

A table with the 2015 arbovirus information for our service area as well as the statewide results is included on page 8. Adult mosquito surveillance began in May and concluded in mid-October. Three (3) full time seasonable employees were hired for the summer to assist our Staff Entomologist in his duties.

LARVAL MOSQUITO CONTROL:

Bti (*Bacillus thuringiensis* var. *israelensis*) mosquito larvicide is a species specific, non-reproducing bacterium and is used to treat areas where mosquito larvae are found. Our field crews will investigate areas we have databased and treat the area if surveillance gathered at the time shows an imminent threat of mosquito emergence. Ten thousand (10,000) pounds of Bti (Bacillus thuringiensis israelensis) was applied by helicopter over two thousand (2,000) acres in 3 towns, Chelmsford, Billerica & Boxborough, and three thousand, one hundred and twelve (3,112) pounds by hand over six hundred and twenty-two (622) acres throughout our service area were applied to area wetlands to reduce the emergence of adult mosquitoes. This represents over two thousand, six hundred and twenty-two (2,622) acres of wetland that was treated with this mosquito-specific bacterium, significantly reducing adult mosquito populations in these areas. We have several thousand areas catalogued that are checked and treated as needed on a routine basis, and many applications are small, measured in ounces. Larval control began in March and continued throughout the month of September.

ADULT MOSQUITO CONTROL:

Our goal is to manage all mosquito problems with education, wetlands restoration or larviciding, but we recognize that there are times when adult mosquito spraying is the only viable solution. In such cases specific areas are treated with either hand-held or pickup truck mounted sprayers if surveillance gathered at the time exceeds a pre-determined threshold to warrant an application. This program is offered on a **request-only** basis, and the exclusion process under CMR 10.03 (21A) allows residents and/or town officials to exclude areas under their control from this or any part of our program. We apply the spray product at the lowest label rate of .0012 pounds of active ingredient per acre (lb ai/A) unless mosquito-borne virus has been identified, and then we will consider other application rates depending on weather and other factors. One hundred and five (105) landing counts were performed by Project field staff as additional surveillance or prior to the application of sumithrin to confirm that pre-determined thresholds of mosquitoes were exceeded to warrant an application. Landing rates are suspended when WNV or EEE is identified in Mass. Adult control began in early June and ended in mid-September with the onset of low nighttime temperatures, reduced service requests and low mosquito population density.

RESEARCH AND EFFICACY

While CMMCP is an agency charged with the control of mosquitoes, we strive to check for efficacy of our products and techniques, and whenever possible perform research in new or different areas of mosquito control. Some of our 2014 Research projects were:

- Asian Tiger Mosquito (ATM) Surveillance in Central Mass.
- Field Trials of Natular™ G30 for Pre-Hatch Control of Mosquito Larvae in Selected Spring Brood Locations
- Aerial Mosquito Larval Control Program
- Field Trials of Natular™ G for Control of *Coquillettidia perturbans* Larvae in Selected Cattail Locations
- 2015 Resident Survey
- Bottle Assays of Field Collected Mosquitoes for Levels of Resistance to Anvil® 10+10 in Central Mass
- Building a Larval-Rearing Cabinet to Hatch Field Collected Mosquito Eggs and for Maintenance of Mosquito Larvae used in CMMCP Educational Programs

The addition of a fulltime Field Biologist in 2007 allowed these research projects to become more standardized, resulting in increased validity of the findings, reinforced by multiple seasons of trials. We have annual strategy sessions in the fall/winter seasons to plan for field trials and other anticipated research for the upcoming year. CMMCP departments as determined by the Executive Director will be expected to publish annually in such journals as the Journal of the AMCA (JAMCA), the NMCA or NJMCA Proceedings, Wing Beats, and other publications. The Field Biologist composes reports as directed, such as weekly surveillance, rainfall data, aerial larval control, etc. and will graph and track trends as directed. These reports will be disseminated to various parties, i.e. SRMCB, MDPH, CMMCP Commission, posted on the CMMCP website, etc.

SOURCE REDUCTION/TIRE RECYCLING

For Earth Day 2010, CMMCP officially announced a tire recycling program added as a value added service to our member cities and towns. This program operates under grant monies received and the CMMCP operating budget. Tire piles provide suitable areas for larval mosquito development, including those species known to carry West Nile virus. During the course of one season, the potential exists for hundreds or even thousands of mosquitoes to emerge from just one tire. If tires infested with mosquito eggs, larvae or pupae are transported, the potential to introduce mosquito species into new areas and/or the potential for the spread of arboviruses and their transmission may increase significantly.

For these reasons and as a value added service to our member cites and towns, CMMCP has developed a used tire program, consisting of the following guidelines:

- We accept passenger and light truck tires only
- The maximum number tires from one property will be 10 at one time, subject to change without notice
- Requests for tire removal shall be done according to established procedures
- We reserve the right to refuse anything determined to be unsuitable for this program

Tires accepted as part of this program will be sent to an approved facility for recycling or disposal. This program is subject to end without notice. There is no additional cost to residents or municipalities; this program is part of the full suite of mosquito control services offered. In 2015 we collected a total of two thousand, eight hundred and twenty-one (2,821) tires in twenty-three (23) member cities and towns. Collections will continue as time and resources allow.

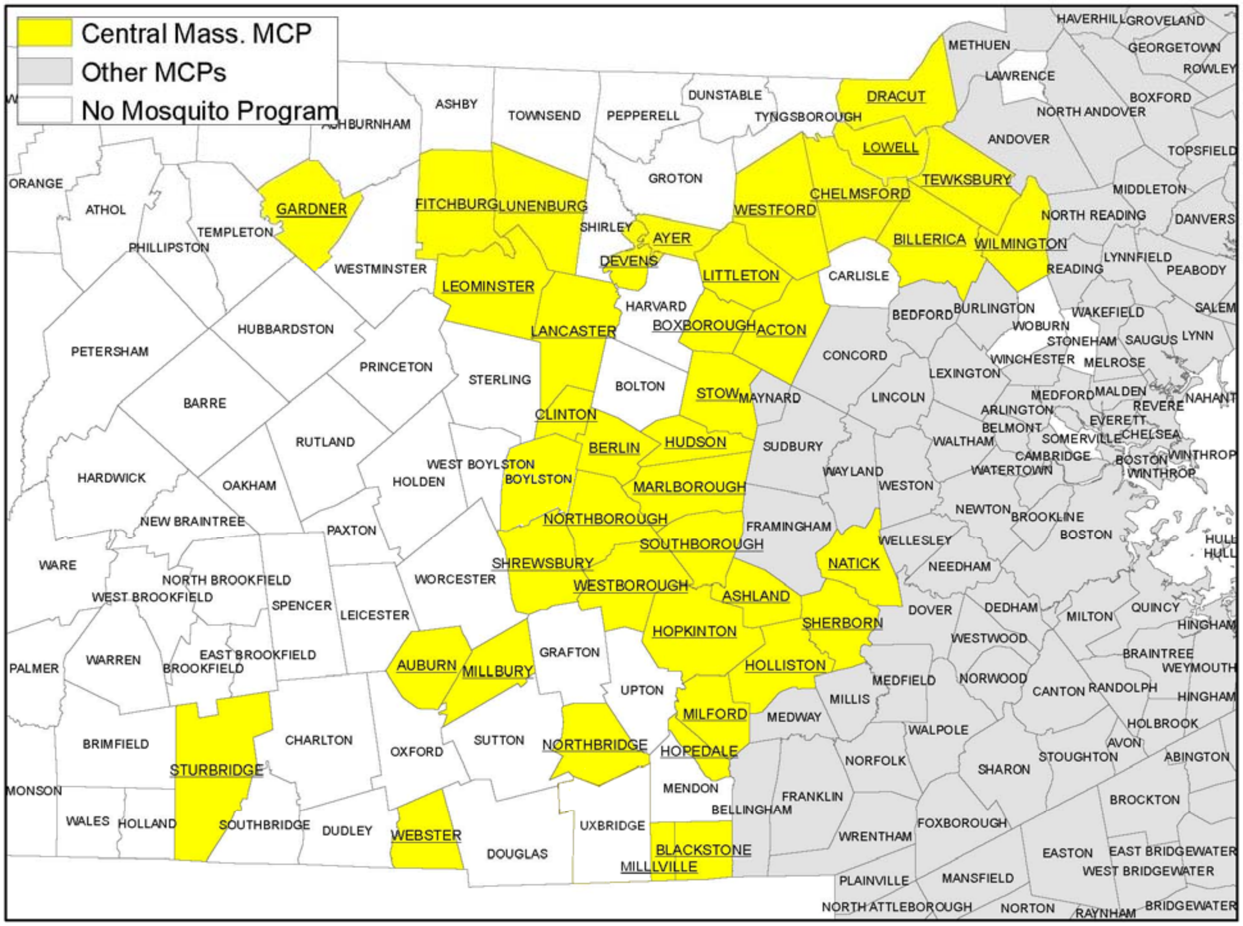
Some additional highlights from 2015:

- Resistance management study; no significant resistance to pyrethroids noted, no change recommended in adulticide material choice (see full report).

- Resident satisfaction survey: conclusion; overall satisfaction with the adulticide program was 95.1%, 99.5% plan to use our services again (see full report).

- CMMCP participates in the EPA’s WasteWise program, tracking our source reduction (tire recycling) efforts. Our efforts in this program were recognized by the EPA – Region 1 in 2014 with an “Environmental Merit Award” for pesticide reduction.

CMMCP SERVICE AREA – 2015



Frank Cornine, CMMCP
Select features of this map courtesy of:
Office of Geographic Information (MassGIS),
Commonwealth of Massachusetts
Information Technology Division

Member,
Northeastern
Mosquito Control
Association

Member,
New Jersey
Mosquito Control
Association

Partner,
EPA Pesticide
Environmental
Stewardship Program

Member, Massachusetts Municipal
Association

Member, MassRecycle

2015 SUMMARY TOTALS

NOTE: A full report of our work done in 2014 in each community is available on our website in detail at http://www.cmmcp.org/14report.htm.

Service Requests	Bti Lbs.	Bti Acres	Adulticide Gallons	Adulticide Acres
16,389	13,112	2,622	297	181,522

Pools Sent to MDPH	Landing Counts	Culverts Cleaned	Restoration Footage	Catch Basins Treated	Tires Recycled
1,319	181	1,110	142,603	84,902	2,821

ARBOVIRUS SUMMARY 2015

WNV Surveillance Summary – Statewide	**2015**
Mosquito Pools Positive	164
Animals Positive	0
Humans Positive	9
EEE Surveillance Summary – Statewide	**2015**
Mosquito Pools Positive	1
Animals Positive	0
Humans Positive	0
CMMCP Surveillance Summary	**2015**
Mosquitoes Collected and Identified	76,060
Mosquito Pools Submitted for testing	1,319
Mosquito Pools Positive WNV	9
Animals Positive WNV	0
Humans Positive WNV	0
Mosquito Pools Positive EEE	1
Animals Positive EEE	0
Humans Positive EEE	0

Town	Total Service Requests	Bti Pounds	Bti Acres	Adulticide Gallons	Adulticide Acres	Catch Basins Treated	Mosquito Pools Tested	Culverts Cleaned	Total Restoration Footage	Tires Recycled
Acton	614	110.0	22.0	8.99	5,480	1,726	27	72	2,040	0
Ashland	331	83.0	16.6	6.08	3,706	2,390	31	31	1,900	91
Auburn	312	61.5	12.3	3.84	2,341	1,910	34	27	2,247	0
Ayer	74	17.0	3.4	1.16	707	1,605	36	42	4,560	0
Berlin	143	58.0	11.6	2.76	1,682	407	34	46	1,860	0
Billerica	644	3089.0	617.8	9.94	6,059	1,733	32	8	3,455	211
Blackstone	243	195.0	39.0	2.90	1,768	942	21	24	3,655	0
Boxboro	85	4454.0	890.8	3.07	1,871	1,494	31	51	2,445	6
Boylston	294	36.0	7.2	8.16	4,974	761	28	42	1,980	0
Chelmsford	483	2726.0	545.2	8.41	5,126	2,821	41	0	7,530	60
Clinton	120	30.5	6.1	1.57	957	604	38	12	1,665	82
Devens	4	13.0	2.6	1.70	1,036	338	33	31	2,035	0
Dracut	725	30.0	6.0	9.95	6,065	2,886	34	12	3,165	174
Fitchburg	61	24.5	4.9	1.02	622	5,868	28	60	1,305	594
Gardner	9	1.0	0.2	0.29	177	2,497	26	21	1,735	0
Holliston	539	96.0	19.2	11.70	7,131	1,821	32	27	2,790	0
Hopedale	197	135.0	27.0	5.10	3,109	1,050	35	8	2,605	0
Hopkinton	801	85.0	17.0	17.05	10,392	2,999	28	10	3,080	0
Hudson	397	39.0	7.8	9.20	5,608	2,835	37	0	7,580	0
Lancaster	164	43.5	8.7	5.66	3,450	1,014	29	31	2,955	260
Leominster	111	38.0	7.6	1.07	652	4,307	30	39	8,255	258
Littleton	386	66.0	13.2	5.42	3,304	529	34	17	2,025	0
Lowell	95	95.0	19.0	1.42	866	7,432	31	15	3,335	3
Lunenburg	532	54.0	10.8	10.30	6,278	1,186	23	24	4,490	117
Marlboro	305	115.0	23.0	4.05	2,469	6,092	31	33	2,340	0
Milford	515	63.5	12.7	12.21	7,442	2,477	35	33	2,597	85
Millbury	500	112.5	22.5	6.91	4,212	1,454	34	27	3,725	154
Millville	169	141.5	28.3	2.91	1,774	815	25	0	13,715	10
Natick	513	42.0	8.4	5.87	3,578	3,325	42	3	5,675	38
Northboro	456	83.0	16.6	8.08	4,925	1,488	32	24	3,210	39
Northbridge	576	114.0	22.8	9.21	5,614	2,048	31	22	2,649	0
Sherborn	161	106.0	21.2	5.18	3,157	601	36	0	4,090	0
Shrewsbury	459	50.5	10.1	8.03	4,894	2,761	35	12	4,250	112

Town	Total Service Requests	Bti Pounds	Bti Acres	Adulticide Gallons	Adulticide Acres	Catch Basins Treated	Mosquito Pools Tested	Culverts Cleaned	Total Restoration Footage	Tires Recycled
Southboro	301	74.0	14.8	6.35	3,870	1,076	27	50	4,160	32
Stow	601	51.0	10.2	12.75	7,771	1,256	35	54	1,510	25
Sturbridge	625	191.0	38.2	9.23	5,626	1,656	33	75	2,215	122
Tewksbury	1060	125.5	25.1	16.74	10,203	2,351	33	5	3,880	250
Webster	196	69.0	13.8	2.44	1,487	1,317	30	46	2,015	0
Westboro	527	50.0	10.0	11.36	6,924	0	38	36	2,045	34
Westford	714	52.0	10.4	15.21	9,271	3,062	33	15	3,330	64
Wilmington	1347	91.0	18.2	24.52	14,946	1,968	36	25	2,505	0
Totals	**16,389**	**13,112**	**2,622**	**297.81**	**181,522**	**84,902**	**1,319**	**1,110**	**142,603**	**2,821**